THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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HEATING AND COOKING BY ELECTRICITY.

WE learn from the *Irish Builder* that in a circular letter to their clients the firm of Messrs. G. N. Haden & Sons, Dublin, say that as some firms recommend the use of electricity for heating and cooking, they take the opportunity of pointing out the waste involved by such a system in these days, when fuel is not only so costly, but is getting more scarce every year. They quote a statement by the chairman of the Dublin Tramway Co. to the effect that by the introduction of new coal-saving devices they were now able to generate 14,309,000 units by the consumption of 21,996 tons of coal. This is equivalent to 650 units per ton of coal, so that out of every 100 tons of coal consumed, only 8 tons can be effectively utilised for heating purposes. Messrs. Haden add that they feel sure that these figures will convince people of the enormous waste involved in heating and cooking by electricity, without going into the further inefficiency by losses in transmission, &c.

On the other hand, it is a significant fact, as shown by Mr. H. C. Hopkins in a paper on "Electric Cooking and Electric Ranges," which he recently read before the N.E.L.A. at Reno, that in spite of the war, with its attendant rise in prices, and the fact that power companies as a whole have not pushed their domestic business, electric range sales have steadily increased throughout the U.S.A. In this country the same phenomenon has taken place, and, in addition to numerous very large installations in the provinces, we can point to the National Kitchens established at Poplar and in New Bridge Street respectively, where public appreciation of their advantages has been manifested by their rapid growth in popularity. The results that have been obtained are all that could be desired, and the success of these establishments is assured. Inspectors from the Ministry of Food, while preferring steam for boiling on the score of economy, cannot speak too highly of the merits of electric cooking, on account of its cleanliness, convenience, uniformity, and other well-known advantages. In particular, they fully endorse the claim that the electric oven effects a material saving in the case of meat, besides retaining the flavour and succulence of the joints in the highest degree.

The advantages and benefits to be derived from the use of electric ranges are numerous; they are sanitary and clean, and the products of combustion—ashes, soot, and fumes—are entirely eliminated, with a resultant saving in labour and cost of house cleaning. Practically all of the heat generated is used efficiently; cooking can be performed with mathematical precision, eliminating guesswork entirely, due to the perfect control and easy regulation of temperature. The time ordinarily spent in watching the cooking of food in a coal or gas range is considerable, and can be saved when cooking is done by electricity. The saving in meat shrinkage is quite considerable, an important feature in these days of food shortage and high costs; and, lastly, the quality of the food cooked is greatly improved, the natural flavours being retained instead of being allowed to escape with the products of combustion.

Statements issued by Messrs. Belling & Co. show that to cook 100 lb. of meat in a coal range requires 100 lb. o

coal; in a gas range 30 lb. of coal (in the gas works), and in an electric range 25 lb. of coal (in the electricity works). If only half the total amount of roasting and baking done each day were done by electricity, the daily saving would approximate 10,000 tons of coal. With regard to meat saving, they say that every 100 lb. of raw meat cooked in a coal range weighs 86 lb. when done. The same amount cooked by gas weighs 70 lb., and by electricity 90 lb. when finished. If only half the total weight of meat consumed each day were cooked by electricity, the daily saving would be approximately 350 tons of meat.

Then we have the statement set forth in a leaflet distributed by the engineer and manager of the Horsham U.D.C. electricity works to his customers, that cooking for a family of 10 with a coal fire from June, 1915, to June, 1916, consumed 4¾ tons of coal, whereas from June, 1916, to June, 1917, cooking by electricity, the coal consumed (at the electricity works) amounted to only 1¾ tons, showing a saving of 63 per cent. Similarly in a household of seven persons, the substitution of electric for coal cooking in 1917 resulted in a saving for 12 months of 64 per cent. Other examples showing the saving of meat are also quoted.

The pity of it is that very few people seem to be aware of these astonishing figures, and the vast saving which can actually be effected. Those in the electrical industry do not push electrical cooking forward as they should do, and those outside the industry seem to try to retard it. Why is there not some co-operative movement amongst manufacturers to drive these points home, when it is so obvious to all who are willing to see it that electric cooking effects an enormous saving in coal, labour, and many other ways? While the conditions may not be favourable at the moment for such a movement, at any rate preparations should be made to set it going at the earliest opportunity.

Any device that will add to the safety of the house is commendable. The use of electricity for heating displaces matches and open fires; there is no gas to explode and no flame or flare-up to start fires or to burn the operator. No business man would think for one moment of going back to the old office methods and discarding the use of modern labour-saving devices such as typewriters, billing machines, and adding machines. These devices are considered necessary to the proper and efficient management of one's business. Electricity in domestic service is simply a modern labour-saving device—saving also money, time, and worry—and, therefore, should be considered as part of the modern housekeeper's equipment.

The points cited above, and others which are readily available, should be thoroughly understood by the range-user or prospective user. Any sales campaign or sales effort calculated to promote the use of electric ranges must of necessity be of an educational nature. Unless the advantages of electric cooking are thoroughly understood and appreciated by the customer, the inevitable result is that the user limits his inquiries to a comparison of the cost of operation with that of the fuel previously used for cooking.

The result of such a comparison is not always favourable to the electric range, particularly where the cost of electricity is higher than 1d. under pre-war conditions per KW.-hour. The customer does not think of comparing the cost of his electric light with the cost of gas or oil lamps, simply because he thoroughly understands that he is obtaining a better light and greater convenience than he formerly enjoyed, and this represents to him a definite value in personal comfort and physical well-being.

Raw Materials and Co-operative Buying.

THE control exercised by the Ministry of Munitions over establishments producing war materials, while it has perhaps been associated with many drawbacks and unnecessary restrictions, has pointed the way to several much-needed reforms as regards centralisation, distribution, and especially of co-operative buying of raw materials. Whereas, in many trades, under the old competitive system, the staple raw materials were purchased from a great variety of sources, and with very little conformity to standard requirements, the view is becoming more and more confirmed that the policy of approximating the total quantities required and ordering under one head will prove the most economical as regards purchase price, the most equitable as to fair distribution and prevention of manipulation by outside agencies, and the best means of combating the difficulties that will ensue as a result of the world's depletion of stocks and means of conveyance.

The leading German manufacturers have been organising to this end for some considerable time, and not, perhaps, without good reason. The benefits of this system were becoming more thoroughly realised by them a few years before the war broke out; and, according to their showing, the results justified the experiment. They are now, of course, more concerned than ever about the sources of their future supplies of raw materials, and it is possible that for some years after the war, if not permanently, the German Government, or its trade leaders, will carry out the purchasing of the whole of the nation's requirements in imported raw materials.

During the present difficult period this country has furnished several successful examples of this system. The Cotton and Leather Control Boards, among others, have proved of great benefit to their respective trades. So, also, in a larger measure, has the Ministry's later control of the imports and distribution of copper, upon which the electrical industries so largely depend. There may perhaps have been a good deal of mismanagement in this section in the past, but it is conceivable that no private sources of distribution could have enjoyed the same preference as regards supplies, shipment, and finance as that obtained by the influence of a representative head supported by the Government of the nation.

We are not advocating an indefinite continuance of Government control, but rather that the system, wherever it has proved itself of advantage to trade, should be continued in the future under the control of the respective trades' representatives, with the support of the Government behind them.

This, we believe, is a problem of far-reaching importance, the solution of which must not be left to Government officialism, nor even to Parliament itself in its present state as regards the representation of trade. It must be solved, and a satisfactory policy must be determined upon by the nation's business men, who throughout the war have proved themselves the best legislators in matters of trade. We are glad to notice that much is being done by commercial men throughout the country to promote a closer co-ordination of purchasing facilities as regards post-war importation of raw materials.

Nationalisation of Electricity Supply in Germany.

As mentioned in this journal on former occasions, apprehensions have been entertained in electrical circles in Germany for a few years past that the Government might seek to convert the supply of electricity into a State monopoly within a period not remote from the present time, and these fears have become accentuated during the course of the war. All doubts on the question, however, have now been removed, at least in the case of Prussia, by the speech which was delivered by Dr. Sydow, Prussian Minister of Commerce, on the occasion of the celebration of the twenty-fifth anniversary of the formation of the Verband Deutscher Elektrotechniker, at the beginning of last month, at the Technical High School, Charlottenburg. The Minister is reported to have stated that, having regard to the important and successful undertakings of a private economic and municipal kind, and to the considerable financial demands which would be generally made upon the State after the conclusion of the war, the Prussian Government did not propose to exclude such undertakings from the production and distribution of electrical energy, or to limit their development. Dr. Sydow added that the State would only tender a helping hand as occasion arose by the erection of special Government works or by State participation in joint undertakings, where this appeared to be appropriate or desirable on account of the nature of the sources of power at the disposal of the State, or for the supply of parts of the country which were weak from an economic point of view.

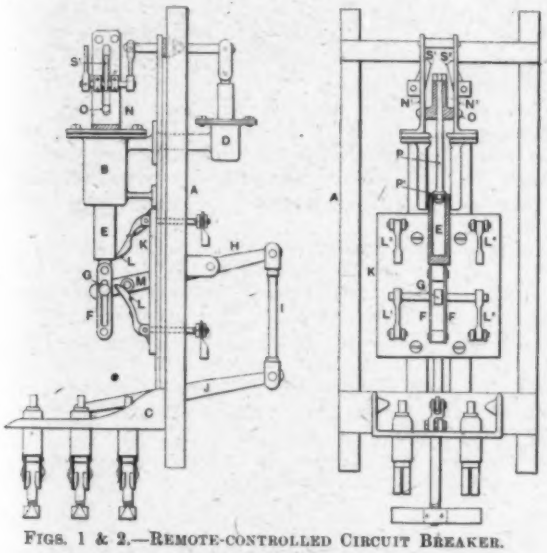
REMOTE CONTROL FOR SQUIRREL-CAGE MOTORS.

By L. E. WOOD.

THIS article describes the advantages of a remote-control system over the ordinary ones usually met with, and relates solely to squirrel-cage motors. The installation about to be described is that of a bleachery in Canada, consisting of 16 motors ranging from 12 to 25 H.P., and supplied from a three-phase system at 600 volts, 60 cycles.

It may not be generally known that bleacheries rank along with collieries, inasmuch as the plant receives very rough handling and accidents are very liable to happen.

The liability of accidents happening is due principally to the following reasons :—First, the floors of such places are always wet, more often than not in running water ; secondly, the operators in the warmer weather go about bare-footed, so that they are very susceptible to shock ; thirdly, as the cloth travels from one process to another, usually through pot eyes hung from the ceiling, it often breaks, or when the end is reached it has a tendency to whip, and in so doing, of course, pulls down whatever it may have whipped around, unless that something is firm enough to resist the strain until the cloth breaks or is seen in time by a workman. A fourth reason is that the very damp, usually steam-laden atmosphere, together with the various chemicals used, has a very injurious effect on all apparatus.



FIGS. 1 & 2.—REMOTE-CONTROLLED CIRCUIT BREAKER.

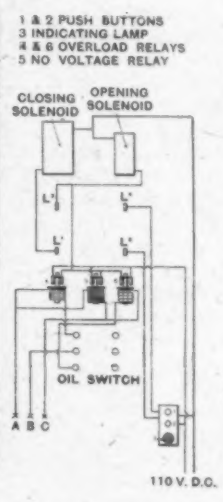


FIG. 3.
WIRING DIAGRAM.

Of the risks described the two most serious are the third and fourth, as they involve risk to life. In the one case the cloth may very easily attach itself to an earth wire, breaking or pulling it from its fastening ; it is not always possible to place or secure the wire so that cloth cannot damage it.

In the second case, corrosion may take place between the joint of the earth wire and the earth plate, if of metal, though to casual inspection it may appear perfect ; in any case, it may introduce a high-resistance joint, and, when an earth fault does occur, it does not effectively protect the apparatus with which it is connected.

In looking for a remedy for the risks just described it occurred to the writer that the only real solution was to remove the risks, which has been done in the following manner :—

Sixteen motors ranging from 12 to 25 H.P. each, of squirrel-cage type, and thrown directly on the line without any compensator or other current-reducing device, are provided with switchgear arranged in groups as near as convenience allows to the motor they are to control.

Each group is fenced in by means of expanded metal and locked, so that none but authorised persons can get in.

Each switch is operated from a push-button control located as near the motor as possible. The control consists of a push-button switch specially made for solenoid-operated switchgear, and has silver contacts ; this, together with a 5-C.P. lamp, is enclosed in a cast-iron box, the lid of which is provided with a small ruby glass, which is illuminated when the switch is closed.

The solenoids are operated by D.C. at 110 volts ; some may consider the use of D.C. a disadvantage, to which the writer would say that, in all industrial plants of any size, D.C. is always available, as it is used for many minor purposes for which A.C. cannot be used.

From the foregoing, it will be seen that by adopting this system of control the handling of apparatus dealing with the working pressure is entirely avoided ; should such a risk occur as that previously mentioned the effect on the workman would be harmless, in any case only a little unpleasant.

It also obviates the rough treatment apparatus usually gets in these places ; furthermore, the system has all the desirable features—such as inverse time relay, overload and no-voltage protection.

A full description of the switchgear designed and made for the job is given below, as this switchgear has several features not usually associated with remote-control solenoid-operated apparatus ; also a diagram of the wiring is given. The accompanying sketches, figs. 1 and 2, show the construction of the circuit-breaker.

A is a frame which carries a solenoid B for closing the oil switch C ; D is a solenoid for releasing C ; E is a plunger to which are connected links F, which in turn are connected by pin G to lever H, and again to rod I and lever J ; K is an insulated base on which are mounted contacts L, 1, 2, 3 and 4 ; M is a rod insulated from H, and bridges contacts L^1 and L^2, fig. 2 ; N^1 and N^2 are guides fastened to the solenoid B, in the slots of which O is free to slide up and down. Attached to O is a rod P which is free to turn at P^1 and is attached to the plunger E, shown in cross-section in fig. 2. The switch operates as follows :—When the button marked "Switch on" is pressed, current is conveyed to solenoid B by contacts L^1 and L^2 through rod M, plunger E is drawn up and is under momentum, or travels the length of the slots in links F, before it commences to lift lever H and closes switch C, and by the time plunger E is in its correct position in relation to the field of solenoid B, O has forced its way past props S^1 and S^2, and rests on top of them, much in the same manner as the cage of a pit shaft does to relieve the rope of its weight whilst undecking. Rod M is now bridging contacts L^3 and L^4, so that when a push button for opening the switch is pressed it closes the circuit of solenoid D, which, on drawing in its plunger, opens out props S^1 and S^2, releasing plunger E, which falls the depth of the slots in links F (inverse action to closing), and strikes the end of lever H a smart blow, causing it to rupture the circuit very rapidly.

No auxiliary relay is used to deal with the main current of the solenoid, and no condensers or buffers are used to protect contacts L, 1, 2, 3, and 4. These switches have been opened and closed many times a day without damage to contacts L, the push buttons, or rod M. As seen in fig. 3, the switch is entirely automatic, and independent of push buttons.

This switch has some features not usually met with in other types. It will be noted that the oil switch is closed by a pull, and not a blow closing a toggle joint, as is usual, and has this advantage, that it is easily adjustable by means of rod P for any length of stroke, without in any way interfering with the plunger, and need not be so precise as a toggle, which must not be a fraction over or under ; furthermore, by the use of links F the plunger is in its most powerful position before it commences to close the switch ; with the other type, the plunger is at its weakest point, *i.e.*, the end of its stroke.

In switches that operate on the toggle principle the opening of the circuit is accomplished by the smaller solenoid tripping the toggle, weight, movable contacts, wooden rods, and cross-bar. If, as is often the case, the movable contacts go in a little too far, or are frozen in by a small blob, an opening toggle switch fails to fall, and it is usually necessary for the operator to hit the cross-bar so that the switch shall open; use is also made of V contacts, which have a repulsion effect, thereby assisting in opening the circuit.

In the switch just described V contacts are used only because they are practically the only type that can be used on this class of switchgear; but the repulsion effect is not relied on so much, for should the blades stick for any reason, the weight of the falling plunger never fails to open the circuit very rapidly. No springs are used to assist the opening.

THE HOUSEHOLD FUEL AND LIGHTING ORDER, 1918.

By T. W. COLE.

The Household Fuel and Lighting Order is of a somewhat complicated nature, and a few notes in elucidation may not be out of place.

In the first instance, the chief point of immediate interest to electricity supply undertakers is Part VIII, which deals with the "Duties of Undertakers of Gas and Electricity Supplies and Other Clauses Applicable Thereto." As the Order takes effect from July 1st, we might consider, first, any provisions which call for immediate observance. A clause which contains such provisions is 99, which reads as follows:—"An undertaker of gas or electricity supply shall not, after the date on which this Order comes into effect, without the previous assent of the Local Fuel Overseer, make any new supplies for the purpose either of lighting or fuel, nor shall it fit or equip or permit or authorise to be fitted or equipped any premises with additional appliances for the purpose of using gas or electricity for fuel without such assent. This clause shall extend to any other persons undertaking the fitting or equipping of premises with appliances for the use of gas or electricity for fuel.

"Where premises have been fitted or equipped for the purpose of using gas or electricity for fuel since May 1st last, the Local Fuel Overseer may, in his discretion, refuse to permit an additional supply of gas or electricity for such premises in respect of such new fittings or equipment."

This clause is very drastic. It applies, be it noted, to all electrical contractors as well as to electricity supply undertakers. It cuts straightway into the business of the former. How far it puts a stopper on all business seems to rest with the Fuel Overseer. Installation work and apparatus sold (and to be sold), therefore, since July 1st, needs careful consideration, for if the same is not sanctioned by the Fuel Overseer the question arises whether the customer can refuse to pay for it, since in such circumstances the work has been done, or goods delivered, in contravention of an Order under D.O.R.A. Presumably, however, the Fuel Overseer will take a common-sense view of all work done in this interregnum, as it were, until the Order is fully understood and in full operation.

From this it would appear advisable for everyone interested to get into touch with the Fuel Overseer for the district at an early opportunity. As the Order provides that the Local Authority must appoint the Fuel Overseer within 14 days (that is, before July 15th), the names of the officials must very shortly be forthcoming, if not already out in some districts.

In the London area, the existing list of Local Fuel Overseers (referred to previously as the Local Coal Overseers) stands as at present, without express confirmation. But we understand that a revised set of appointments will be made shortly. In fact it seems obvious that the gentlemen in the present list (Borough Surveyors, Public Librarians, &c.) cannot fulfil the now very onerous duties they are allotted under the present Order.

With regard to further instructions to Electric Supply Authorities, the most important clause is that which provides that undertakers must within six weeks of the close of the quarter furnish the Local Fuel Overseer with a list of all consumers who have exceeded their ration, as shown on the certificates sent to the undertakers by the Overseer; this is a matter quite simple in theory but entailing, in big undertakings, a prodigious amount of clerical work, and possibly a shoal of correspondence. Still, however troublesome, it is unavoidable for the due working of the Order. The interesting point will be to see how long it will take the Fuel Overseer to send the necessary certificates to the undertakers, an unenviable job, considering the peddling detail labour involved in deciphering and the hotch-potch character of many of the requisitions sent in by the more illiterate and non-arithmetical of the householders.

A difficult problem to deal with will be that of the slot meter consumers. However, as these cover usually quite small consumptions, electricity supply authorities will, perhaps, not be unduly pressed over the detail working in these cases.

The clause providing that electricity undertakers shall maintain reserve stocks of coal seems somewhat superfluous. The trouble in this direction is not being unwilling to do so, but being unable to do so. Still, the clause may be taken as conferring on the undertakings a certain advantage, since they can claim obligations under D.O.R.A. when pressing for deliveries.

The foregoing by no means exhaust the obligations, but are merely a summary of the chief ones from the undertakers' point of view. Finally, as the undertakers will be constantly called on by consumers for advice, there is the further obligation on them to digest, and have at their finger ends, the details of the Order in every particular.

TRADE UNIONS AND INCORPORATED ASSOCIATIONS.

The following is an abstract of an address given to the Electrical Power Engineers' Association at St. Bride's Institute, London, by Mr. A. C. Bostel, chairman of the Southern Division, Mr. C. H. Wordingham, president of the I.E.E. being in the chair:—

Because of the veiled and unveiled objections which exist to our choice, for the Electrical Power Engineers' Association, of trade-union registration, I have felt it essential that at as early a stage as possible in our reconstruction an explanation should be given of the causes which have weighed in our decision for registration in preference to incorporation.

Trade unions may be defined shortly as associations of workers for regulating the relations between craftsman and craftsman, craftsman and employer, or employer and employer, and for imposing conditions on the conduct of any trade profession. Their legislative strength of to-day, which in the hands of some of their leaders approaches a menace to the welfare of the state, was not attained without great effort, and one cannot but admire in the history of trade unionism the spirit of those men who for their principles were prepared to make bitter sacrifices.

It is clear that trade unions are a sort of corporation, incorporated by statute, and very closely resemble incorporated associations such as railway companies, but the freedom of a trade union to add to its objects by altering its rules is very much narrower than that of an incorporated association. Under the Companies Act, 1908, a company may alter its articles of association subject to certain conditions, but a trade union must not exceed the powers given to it by the Trade Union Acts of 1871-76. It appears, therefore, that this is the most important difference between a trade union and an incorporated association; the latter may be formed for any lawful object desired by its promoters; these objects are set out in its articles of association, and to them the association must confine itself. It may at any time, by the approval of the Court, alter or add to the original objects, to carry on its business more efficiently or to maintain or improve its conditions. Under the Trade Union Acts, however, a trade union may only be established by strictly conforming to the objects defined by the Act; these objects the union must state, but they must not include any object not defined by the Trade Union Act.

It is a mistake to assume that trade unions are not liable to tort, because they certainly are, except in cases bearing directly on any action for the furtherance of a trade dispute, but as no self-respecting trade union would be so foolish as to commit any action which would be liable to criminal prosecution, other than in the interests of a trade dispute, I do not propose to dwell on this. It must be understood,

however, that this protection from tort is the strongest power given to trade unions.

With reference to benevolent funds, the majority of trade unions and many incorporated associations offer to their members sick benefit and superannuation allowances, but trade unions cannot give to their members any legal security that they will enjoy these benefits, unless funds collected by subscriptions or optional levy are put aside for such purposes, and expressly specified as such. The subscriptions nearly always go to the common fund, and are used primarily for trade purposes, and such benefits as are offered are only forthcoming when there is money to spare and the society has power to pay it. To get over this difficulty, our national executive has decided to encourage the members of the Electrical Power Engineers' Association to subscribe to an incorporated society—The Electrical Trades' Benevolent Institution.

We now come to the vicious principle of a strike, which is always associated with trade unions, but under a different word it is often practised by associations and companies. Surely if it is practicable for a combination of, say, milk dealers, to sell milk only at their agreed price, it is no scandal for a body of craftsmen to say that they will only sell their skill and labour at a price which they decide on; but whereas in the former case the hardships are inflicted on others, in the latter it is on the strikers. I do not give this example to mean that to strike is the proper thing to do, it certainly is not, any more than it is right for a combination to form rings to lift up prices and eliminate competition. The power to strike is, however, a very powerful weapon, and should never be unsheathed except after every possible method of friendly arbitration has failed, and I am sorry to say that this method is forced on craftsmen by the attitude adopted by employers of labour. It should be borne in mind, however, that some of the greatest strikes have been carried out without the aid of trade-union organisation; and, on the other hand, many trade unions have never resorted to such methods. It must be understood, therefore, from the foregoing remarks that our association, the Electrical Power Engineers' Association, holds broad views on the subject of the title of this paper, but I do not feel that there is need for any side to take drastic action. The whole trouble in the past between employers and employés has been the want of education in the value of one another, each to each. The employers have not, until recent years, made a study of their men, nor have the men made a study of their employers, and hence the sole object of one is to get as much out of the other as possible. Now all this is very wrong; it has always been the differences, the alleged wrongs, never the broad-minded principle—the great common interest of the industry itself.

An industry is something far greater than the men who make up that industry, it calls for the mutual co-operation of all who make it what it is. Its success depends largely on this co-operative feeling existing between the workers, both manual and intellectual, and it is this mutual feeling which in the future will no doubt exist in all industries. We have seen it in an indirect way during the present struggle.

Were this co-operation to be carried out on broad principles we should not only avert strikes and lock-outs, but should witness a vast increase in the prosperity of our Empire, such as has never been seen in the course of our history.

ELECTRIC POWER SUPPLY.

On June 11th a deputation of members of the Trade Union Congress Parliamentary Committee and officials of the Electrical Trades Union interviewed Sir Albert Stanley, President of the Board of Trade, with regard to the proposals of the Committee on Electric Power Supply. The E.T.U. was represented by Messrs. J. Rowan (General Secretary), J. Muir (Executive Council), and H. H. Morton (Secretary of No. 1 Branch, London Station Engineers, from whom copies of the full report can be obtained, price 2d.). From the quarterly report of the Parliamentary Committee we learn that Mr. W. Thorne introduced the deputation, and said that Labour had repeatedly declared in favour of public control as against uncontrolled State ownership; it believed that if the huge concern referred to in the report was set up and put in the hands of private enterprise, it would mean the exploitation of the workers and of the private consumer. It would be much better to have a number of huge generating stations instead of so very many small plants; but the interests of Labour and the public generally must be thoroughly safeguarded.

Mr. J. H. Thomas said there was common agreement as to the advisability of a large scheme and generation in bulk. The first governing principle must be public ownership, as distinct from municipal ownership; Parliament would be the ultimate authority, and there would have to be some form of central authority on which Labour must be adequately represented. Provision should be made for compensating workers for loss of employment. Electric power was wanted not only for industrial purposes, but also for the purpose of bringing comfort to private homes.

Mr. J. Rowan said that his society held that bulk supply was necessary in the interests of Labour, which could only be safeguarded by public ownership and public control. Labour should be represented on both the National and the District Boards; consumers were to be represented, and would have the right to say what the conditions of employment should be. Before the Report would be acceptable to his members it would have to be considerably modified. Compensation for displacement should be extended to workmen as well as officials.

In reply, Sir Albert Stanley said the Government looked upon this matter as one of the most important of the many reconstruction problems; a cheap supply of electricity would go far to improve the industrial situation, and he was glad to know that they would have the support of Labour on that point of principle. The Board of Trade intended to press this matter forward as rapidly as possible, and would endeavour to bring in a Bill to deal with it as soon as time could be found in the House of Commons to do it. It seemed imperative that if a national scheme of electricity supply was going to be established, no extension should be made, other than what was absolutely necessary, unless it could be made to fit in with the national scheme. The Sub-committee of the Coal Conservation Committee had reported that such a scheme would mean a saving of 50 million tons of coal and 100 millions sterling a year; there was therefore a colossal waste now, and because that sub-committee decided to make certain recommendations the Board of Trade appointed a committee on the subject. He had no doubt but that this country could produce electricity just as cheaply as any other. He thought the right course to follow was to appoint an Electricity Commission which should be responsible to the President of the Board of Trade, who was responsible to Parliament; but it would not be proper for him to give any indication of the policy of his department and of the Government until they had had an opportunity of considering the recommendations and consulting some of the interests whose advice would be beneficial. They hoped to be able to draft a Bill very shortly, and the three points raised would be carefully borne in mind, namely, that the power stations should be publicly owned; that Labour should be represented on any scheme providing for the administration of this undertaking; and that provision should be made for compensating any employé whose position might be disturbed. There was every probability that people would be benefited by the new arrangement and secure electricity much cheaper.

Mr. Rowan pointed out that the Report suggested that 50 per cent. of the capital should be provided by the State, and there was no guarantee that private profits would not be made by the other 50 per cent.; but Sir Albert replied that criticism should be directed towards the Bill when it was brought in; the Report could only be taken as a guide in framing the measure.

LEGAL.

Rio Tinto Co., Ltd. *v.* A. E. G. Electric Co., Ltd., and A. E. G. Electric Co., Ltd. *v.* Rio Tinto Co., Ltd. (Consolidated).

(*Continued from p.* 9.)

Mr. Grant, K.C., in continuation of his opening, raised the question of an amendment of the pleadings in relation to the interpretation of the contract in regard to special damages.

Mr. Colefax, K.C., for the Board of Trade, said the proposed amendment brought in the allegation of breach, and the pleadings must not be so altered as to go outside the arbitration decision.

The Official Referee said he would allow the amendment to the pleadings. There was nothing in the proposed amendment which was going to enable the plaintiffs to take any such course as Mr. Colefax seemed to be afraid of.

Mr. Arthur Stebbins Clift, the agent of the Rio Tinto Co., gave evidence as to the proposed alteration in the plant at the company's works and the arrangements which were made in June, 1912, for the supply of the new turbo blowers. At that time, he said, letters inviting tenders were sent, amongst others, to the A.E.G. Co. He had a discussion with Mr. Adler as to the practicability of making turbines for the required pressure and volume which would have an efficient steam consumption. He also desired information about an alternative scheme for driving the blowers by electric motors. Witness then went on to describe in detail the various interviews which he had had with Mr. Adler in reference to the transaction, and was cross-examined by Mr. Colefax as to the dates at which the various orders had been given in reference to the machinery and the evidence which he had given before the arbitrator. Asked as to the nature of the claim in regard to damages, witness said that he had based it upon the actual production during 17 months from July, 1915, to December, 1916; the total amount of copper extracted from the ore during the 17 months he had mentioned was 10,161 tons.

Witness was cross-examined at great length upon the details of the work done at various dates as shown by the tabulated statements and upon the claim of £184,000 loss of profit consequent upon the failure of the machine.

On Monday, July 8th, the sixth day of the hearing, defendants' counsel, by permission, interposed a witness named Ronie. He said that he was in 1915 employed by the A.E.G. as an erector, and he was now employed by Dick Kerr & Co. He went to Rio Tinto with Mr. Doughty in March, 1915, in connection with the trial of the turbine. The second attempt

to start the turbine with the new shaft took place in February, 1916, and his expenses were paid by the A.E.G. Co. Before he went out he attended several times at Fraser & Chalmer's works where the new shaft was being manufactured, and his charges for those attendances were paid by the defendants.

In cross-examination by Mr. GRANT, K.C., the witness said that Dick Kerr & Co. took over such business as the A.E.G. Co. had left in England, and he acted for them in connection with the Rio Tinto business. He was not examined before the arbitrator as to what took place at the second trial. He did not have money advanced by the Rio Tinto Co. while he was in Spain. In all he had done he had acted under the orders of the A.E.G.

Mr. CLIFT, whose cross-examination had already occupied four days, was recalled and further cross-examined by Mr. COLEFAX, K.C., as to the refusal of the Rio Tinto Co. to make the second payment. He said that at the time of the refusal the defendants had been pressing for payment.

Questioned upon the correspondence which had passed between the mines manager and the agents in London in reference to the delay in payment, he said that the Rio Tinto Co. would have been willing to carry out the test if it was so desired, but they preferred that the defendants should have a man there when the tests were made. It was originally intended that two engineers from Berlin should be present at the mines, bringing with them Pitot tubes to carry out tests as to the volume of air.

Mr. COLEFAX: And we gave you warning that if you started without us, yours would be the responsibility.

WITNESS: Yes.

Mr. COLEFAX: You, as works manager, think it was unnecessary that the machine should be overhauled before it was put under steam?

WITNESS: I do not think detailed overhauling was necessary.

A letter from the defendants was read disclaiming all liability if the machine were put under test without overhauling by competent men, and witness said he was told by the defendants that the company would prefer that their representative should be present at the tests. It was not, he said, their intention to make tests without reference to the defendants. They would rather have had them there at the time. They said that they would have an engineer present when the equipment was started.

(To be continued.)

CHARGE OF FRAUD.

ALBERT MIDDLETON, cabinet maker, Borough Road, Seacombe, was summoned last week for fraudulently consuming Corporation electricity. It was stated that when a previous tenancy expired the defendant connected his sitting room and workroom with the main wires left in the building, a thing which could only be done by a person possessing technical knowledge. A fine of £10 was imposed.

THEFT OF CURRENT.

AT Musselburgh Police Court, HELEN WALKER, or THOMPSON, 48, Market Street, Musselburgh, was fined £1 for the theft of 10s. worth of electric lighting current which had been passed round the meter by means of pins and wire.

BREACH OF LIGHTING REGULATIONS.

THE Penarth Electric Lighting Co. has been fined 20s. for a breach of the Lighting Order. The police evidence showed that when a visit was paid to the electric light station at 1.40 a.m. on May 31st the windows of the premises had not been obscured. There were also two standard lights in the yard which could be seen from the sea.

ISAACS *v.* HOBHOUSE.

IN the King's Bench Division (Mr. Justice Darling) last week it was arranged that July 16th would be a convenient day for the trial of this action between Sir Godfrey Isaacs and Sir Charles Hobhouse.

WAR ITEMS.

Women Electrical Workers after the War.—According to the Manchester *Daily Dispatch*, delegate meetings of the Electrical Trades Union were held in various centres throughout the country on Sunday to consider a series of resolutions dealing with armature winding after the war, which were adopted at a recent general conference held in Blackpool. The Manchester meeting endorsed the policy recommended by the Blackpool conference. Under this programme, at the conclusion of the war the Electrical Trades Union will refuse to allow women to perform armature winders' work, and they will also ask for the removal of all cheap labour. One proposal that found acceptance at Manchester was that a secret mark should be placed on all machines made or wound by women or assembled by cheap labour. An attack will also be made on the premium-bonus and piece-rate systems.

Exemption Applications.—At the Hull Tribunal recently, Mr. Rowan, secretary of the Tramwaymen's Union, in supporting the application of a grade 2 man for exemption, stated that 300 men had joined the colours, and they desired to keep the remainder of the men to avoid the introduction of women drivers, to which they were strongly opposed. The application was refused.

Before the Kesteven Appeal Court, the Urban Electric Supply Co., Ltd., appealed against a final month's exemption granted by the Grantham Tribunal to T. H. Heritage (28, grade 1), superintendent, and A. W. Lockton (30, grade 1), stoker, and the National Service Representative appealed against three months each allowed to W. J. Copsey (40, grade 1), engineer; J. E. Edmundson (39, grade 1), manager; W. J. Mann (33, grade 1), labourer; J. Tazzyman (39, grade 1), labourer; A. Parnham (33, grade 1), wireman; and P. A. Baxter (28, grade 1), wireman. The appeal for Lockton was withdrawn, Edmundson was exempted until December 31st, and in each of the other cases the men were given extended exemption to the end of September.

At Stratford-on-Avon an appeal was made by P. W. H. Dove (46, grade 1), electrical engineer. He stated that he supervised several private installations, and had a contract for a plant at Elmdon Hall and at another place to be utilised as a hospital for wounded American officers. The National Service Representative contended that the work at Elmdon Hall could wait until after the war, and appellant replied that before he took the contract he called at the recruiting office, and was given to understand that men over 45 would not be wanted before October. He complained that two younger men engaged on electrical work at another place he named held protection certificates. The National Service Representative contended that Dove was not in a certified occupation, and it was pointed out that the contracts were taken prior to the Act affecting older men coming into force. Three months were granted.

At Sutton-in-Ashfield exemption was sought by R. W. Bance (38, grade 1), electrician with Mr. B. Walton. Applicant, who asserted that he was induced to part with his protection certificate under a misapprehension, had his appeal refused.

At Mansfield, the National Service Representative appealed against conditional exemption held by G. Cooper (grade 2), electrician. The Tribunal held that he was in a protected occupation, and the appeal was refused.

Before the Somerset Appeal Court, an occupational claim was made by Wallace Baker (31, Class A), electrician, with Messrs. Fox Bros. & Co., of Wellington, who has been de-certificated. It was stated that Baker held a protection certificate, and the firm asked for exemption or leave to reinstate an appeal for him in the event of the certificate being withdrawn. Six months were conceded.

Bermondsey Tribunal have adopted a resolution calling the attention of the Ministry of National Service and the Local Government Board to the fact that a large number of young men who came under the provisions of the earlier Military Service Acts still hold protection certificates or other forms of exemption to which no conditions were attached, either from the Munitions Area Recruiting Officers or the Port of London Authority, and that the Tribunal were of opinion as they were now called upon to decide applications for exemption from men graded 1 and 2 between 40 and 50 years of age, that all such certificates should be at once reviewed, and only renewable on applications by the employers and men to the appropriate local Tribunals.

At Ilfracombe, on July 2nd, appeals were made by H. J. F. Stewart, resident electrical engineer; T. H. Sanders, electrician; and A. J. Rudd, relief stoker, for the electric light works. Each was granted three months' exemption.

Mr. D. Munro, electrical engineer to Exeter City Council, appealed for the retention of A. G. G. Buchanan (32, Class A), shift engineer, and said that the staff had been reduced to a minimum. The man was exempted until October 31st or until an efficient substitute is found.

Watford Tribunal has referred to the County Appeal Court an appeal filed by W. R. Dyer (19, grade 1), electric fitter.

At the Norwich Tribunal, Mr. J. W. C. Daynes appeared on behalf of the employers to resist the appeal of the National Service Representative in respect to the exemption of the chief cashier and ticket clerk of the Electric Tramway Co. The man has been eighteen years with the company, has been responsible since 1906 for all takings and the issue of tickets and prepares all the office returns. It was held that a substitute could not be found because the work required special training. Lady clerks had been tried, but could not do this man's work. The application of the National Service Representative was dismissed.

Price of Coal.—The Board of Trade has made an order providing for an increase of 1s. 6d. per ton in the price of all coal dispatched from the colliery for consumption in the United Kingdom, on and after Monday, July 8th, to meet the cost of the increased war wages recently granted to the miners. The price of coal had already been raised by 2s. 6d. per ton on June 24th. On June 28th an advance of 1s. 6d. a day was granted to miners over 16 years old, and 9d. a day to those under 16.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Instruments for Central-Station Switchboards.

It was only to be expected that Mr. Stubbings's article in your issue of June 14th should call for a rejoinder from a champion of the motor meter, but I am surprised to note the form which this reply has taken. Very rarely indeed does one see in the "Correspondence" columns of the technical Press such a spiteful and personal attack against the productions of a particular manufacturer as that made by "A.M.I.E.E." in your current issue. In this connection, I need only refer to the penultimate paragraph of his letter.

Mr. Stubbings is accused of *undue* bias in favour of the "Aron" meter, and perhaps, therefore, he will excuse me if, as engineer of Aron Electricity Meter, Ltd., I state that he is entirely unknown to us, except by reputation. Presumably, therefore, any bias which he may possess must be the result of his experience of meters under practical working conditions, and this is borne out by the fact that, until quite recently, he has been connected with a station in which, I believe, both mercury watt-hour and "Aron" meters have been used.

Thus, against the moderately-expressed views of an actual user of all types of meters, we have only the extravagant claims and criticisms of an individual who, for reasons best known to himself, prefers to hide his identity.

I am glad to see, however, that our anonymous friend does admit that brake magnets weaken, though he minimises the fault on the ground that this can be made apparent by calibration "at least once per annum," and that it tends to counteract another fault due "to the effect of dust, wear, &c., on the meter." On the other hand, your readers will note that the worst he can say against the "Aron" meter is that two of them, and these of a type now superseded and improved upon, differed on test by as much as 2 per cent.

I would like to mention, too, that the "series of tests" referred to by your correspondent covered other working conditions, such as, for example, accuracy under varying pressures, about which your correspondent is silent. Further, the test results were offered to ourselves and to our competitors conditional on each party agreeing that the other should receive the full report on *both* makes of meters, a condition which our competitors could not accept. These facts are, I think, significant!

F. A. Nield.

London, N.W., *July 9th*, 1918.

BUSINESS NOTES.

Erinoid, Ltd.—A further development in the commercial combat with German industrial monopoly was marked by the bringing into use on Friday, for the first time, of a new power installation which Erinoid, Ltd., of Stroud, Gloucestershire, has found necessary to meet the demands made upon it both by the Government and by private firms. The company's product, "Erinoid" (see Electrical Review, page 618, June 8th, 1917), a new British insulator and non-inflammable substitute for ivory, horn, tortoiseshell, ebony, &c., is claimed to be an improvement upon what was formerly a German product, "Galalith," which had a monopoly all over the world. Large quantities of Erinoid are being made by the company for export for war material purposes. After a brief opening ceremony in the new power house, a party of visitors was conducted over the works to inspect the various processes by which dried and powdered skimmed milk is converted into what, so far as the Erinoid Co. is concerned, is the finished article. It was pointed out that the factory derived its raw material entirely from abroad, and did not in the slightest degree affect the food products of this country. The raw material was drawn mainly from the Argentine, India, and New Zealand, and some of it came from France.

Book Notices.—*M. & C. Apprentices' Magazine* for July is well up to the high standard set by its producers; its literary qualities are such as would be expected of Scottish authors; the articles deal with a wide range of interesting subjects—technical and otherwise—and the illustrations are excellent. Not the least interesting feature is the list of workshop suggestions, for which bonuses have been granted ranging from 10s. 6d. to five guineas. We must again tender our congratulations to the "Apprentices."

"Détermination et Etude des Caractéristiques d'Eclairement des Projecteurs," and "Répartition de l'Eclairement produit à grande distance par les Appareils Optiques de Fresnel." By MM. A. Blondel and Ch. Lavanchy. Reprints from *Annales de Physique*. Paris: Masson & Cie.—In these papers, of which complimentary copies have been sent us by the authors, the theory of the searchlight projector is treated of, with special reference to the distribution of light over the cross-section of the beam, of which the importance, with regard to the visibility of the object illuminated, is very material. In the first paper reflecting apparatus are considered, and in the second dioptric and catadioptric lenses. Various cases are dealt with, corresponding to different conditions of focusing, &c., and simplified methods of calculation are developed by which the characteristics of a projector of given dimensions can be readily ascertained. The second paper extends the methods to the case of systems of lenses. These studies will be of value to those engaged in the design of such apparatus.

"Membership Booklet, 'C,'" issued by the Institute of Metals, contains a list of officers, an appeal for increased membership (the roll now exceeds 1,000), an account of the activities of the Institute and the advantages of membership, and numerous testimonies to the great value of its work, as well as portraits of the distinguished men who have presided over its proceedings. Copies can be had on application to the Secretary, Mr. G. Shaw Scott, 36, Victoria Street, S.W. 1. There will be a ballot for the election of members on July 17th.

"*Memoirs* of the College of Science, Kyoto Imperial University," Vol. II, No. 6, contains papers on the effects of an electric field on the spectrum lines of hydrogen and helium, the figures produced on photographic plates by electric discharges, and other electrophysical subjects, with many illustrations of the greatest excellence.

"Electric Motors and Control Systems." By A. T. Dover. London: Sir Isaac Pitman & Sons, Ltd. Pp. xvi. + 372; 315 figs. Price 16s. net.

Patents and Designs in South Africa.—By Order in Council, on June 25th, the provisions of Sec. 91 of the Patents and Designs Act, 1907, were made applicable to the Union of South Africa.

Catalogues and Lists.—Keighley Gas and Oil Engine Co., Ltd., Imperial Works, Keighley.—Forty-page catalogue containing very full information, accompanied by excellent half-tone and line drawings, regarding their "Imperial" vertical engines, petrol-electric generating sets, &c. Pictures of several bays at the firm's works are shown.

Austin Motor Co., Ltd., Longbridge Works, Northfield, Birmingham.—Publication of over sixty pages (art paper), containing excellent half-tone illustrations of their small electric generating sets (3, 3·5, 8, and 18 kw.), with full tabulated details of spare parts and instructions respecting ignition, carburation, cooling, starting, valve-timing, &c.

British Thomson-Houston Co., Ltd., Rugby.—Descriptive list, No. 5,100 (12 pages), containing a full account, with illustrations, tabulated dimensions, and shipping particulars, of their hand-operated starting rheostats for c.c. motors.

Australian Industries.—Referring to our recent comments on the question of branch British factories in Australia, we observe that Mr. Bonar Law has informed the Australian High Commissioner that everything will be done to meet the wishes of the Commonwealth Government in establishing Australian industries with the assistance of British capital.

The Straits Settlements.—The Imports and Exports Office, Singapore, has lately issued some figures which show that during last year telegraph and telephone material to a value of £21,490 was imported into the Straits Settlements from Great Britain, as against only £1,980 from Japan.

Manufacturers' Conference.—On Tuesday, July 23rd, at 2.30 p.m., at the Central Hall, Westminster, there will be a conference of British manufacturers, under the chairmanship of Mr. George Terrell, M.P., president of the National Union of Manufacturers (Inc.), who will be supported by Sir E. Carson and others. Firms who desire to receive tickets should communicate with Mr. G. R. Cheesman, the Secretary, at 6, Holborn Viaduct, E.C. 1.

Dissolutions and Liquidations.—Standard Bitumen Co., Ltd.—In voluntary liquidation. Mr. S. R. Sheppard, 20, Budge Row, E.C., liquidator. Meeting of creditors, July 17th.

Monometer Manufacturing Co., Ltd.—Creditors must send particulars to the liquidators (H. T. Ledeam and G. G. Poppleton, 26, Corporation Street, Birmingham) by August 12th.

Bankruptcy Proceedings.—Connold, R. E., Canterbury.—Order made June 11th discharging bankrupt conditionally.

LIGHTING AND POWER NOTES.

Accrington.—The T.C. has agreed to supply Messrs. Lang Bridge, Ltd., with a supply of 250,000 units per annum. The estimated annual revenue will be £1,000, and it will cost £260 to connect the works with the nearest main.

Argentina.—According to the *Morning Post*, the Buenos Aires Municipality has taken energetic steps to prevent the German Electric Supply Co. from suspending its services to the public on the pretext of the shortage of fuel.

Australia.—The Huntley (Victoria) Shire Council has applied for authority to supply electricity for public purposes.

The Lismore (N.S.W.) Municipal Council has decided to borrow £15,000 to finance an electric lighting scheme.—*Tenders.*

Ballymoney.—PROPOSED E.L. SCHEME.—The U.D.C. has informed the Gas Co. that it is desirous that the proposed electric lighting scheme should be proceeded with at once.

Bedford.—YEAR'S WORKING.—The annual accounts of the borough electricity department for the year ending March 31st, 1917, show that the revenue amounted to £32,406, and the expenditure to £21,256. The total number of units sold was 4,115,733, including public lighting, 13,910; sewage pumping, 218,273; private lighting, 574,475; and power, 3,309,075.

Birmingham.—WAGE INCREASE.—With regard to the extension of the 12½ per cent. bonus to the employés of the non-certified departments of the Corporation, the Committee on Production has decided that the present advance be increased to 25s. per week.

Burnley.—YEAR'S WORKING.—The income of the borough electricity department for the year ending March 31st, 1918, was £38,044, compared with £34,341 in the previous year. The works costs amounted to £20,353, against £17,006, and the net profit to £4,101, against £3,464. Interest and sinking fund charges were £13,745, against £13,870. The number of units sold was 5,698,532, an increase of 159,888. The works costs per unit was '699d., against '622d., and the gross costs 1·436d., against 1·419d.; 48 new consumers were connected, against 58 last year, owing to the restrictions laid down by the Ministry of Munitions.

Coventry.—YEAR'S WORKING.—For the year ending March 31st, 1918, the income of the Corporation electricity department amounted to £197,987, or '866d. per unit, compared with £169,787 in the previous year. The total expenditure (including interest, £20,358, and loan redemption, £20,161), was £181,666, or '794d. per unit. The total number of units sold was 54,854,340, including power, 52,453,060; private lighting, 1,925,719; heating, 252,391; traction, 223,170; and street lighting, 14,009. The total works costs were £118,926, or '563d. per unit.

Bristol.—STREET LIGHTING.—The Diesel engine at the electricity works, which has been the subject of much controversy, has been sold, and the engine is to be shipped to S. America.

The loan charges on the original street lighting system will be liquidated this year, and, in view of this, the Electricity Committee has been asked to modify the charges. At present the electric lamps, with certain necessary exceptions, are not lighted at night, but it has been resolved to resume the street lighting on September 1st.

Continental.—NORWAY.—Official statistics covering the period 1897-1915 show that the number of industrial plants increased from 9,422 to 15,754. During the same period the horse-power, both steam and electric, increased from 172,396 to 1,261,205. From 1900 to 1915 the number of electric motors increased from 391 to 18,313, and the horse-power roughly from 3,000 to 243,000.—*The Times.*

Elland.—LOAN SANCTION.—The Council has received permission to borrow £2,000 for the purpose of electricity works extensions.

Godalming.—PRICE INCREASE.—The tariff for energy has been advanced as follows by the Urban E.S. Co., as from the quarter ending September:—Lighting to 8d. per unit; power and heating by 10 per cent.; weekly payment consumers, an extra 1d. for all excess units.

Grantham.—PRICE INCREASE.—The Urban E.S. Co. has, from July 1st, increased the price of energy for power and heating by a further 10 per cent., making a total war advance of 40 per cent.

Halifax.—ANNUAL ACCOUNTS.—The working of the electricity department for the year ended March 31st last shows a profit of £12,033, compared with £12,694 for the previous year, and after providing for the 1½ per cent. contribution to the relief of rates and other special items, there was a net loss of £1,182.

Isle of Wight.—PRICE INCREASE.—The E.L. and P. Co. announces the following increased charges for energy for the quarter ending September:—Lighting to 8d. per unit; power and heating, 10 per cent. increase; slot meters, an additional 2d. in the 1s.; weekly payment consumers, 1d. per unit extra for eight months, and 2d. per unit for excess units during the four summer months.

Kendal.—The Council has decided to transfer £605 from the general district fund to the electricity account, to meet the deficiency for the year ending March 31st last.

Leeds.—EXTENSIONS.—Arrangements are being made for the formal opening, at the end of this month, of various extensions to the Corporation electricity undertaking, carried out during the past three or four years at a cost of nearly £250,000. These extensions are part of a larger scheme intended to enable the Whitehall Road works to meet a demand for 60,000 H.P. Since the commencement of the war the energy supplied for power purposes has nearly doubled in volume. Almost immediately the Corporation will find it necessary to expend about £120,000 upon further generating machinery, and extensions to the boiler house and circulating pump house. The average price of energy is 1·14d. per unit, about 20 per cent. above pre-war charges.

LOANS.—The Corporation has decided to renew its application to the L.G.B. for sanction to borrow £5,650 for the purchase of land adjoining the electricity works when the present restrictions on borrowing are withdrawn, and in the meantime to complete the purchase.

Lincoln.—EXTENSIONS.—At a meeting of the City Council, the chairman of the Electricity Committee reported on an interview with the directors of the Electric Power Supply, Sir John Snell, and the L.G.B. with reference to the proposed purchase by the Corporation of the power station of Messrs. Clayton and Shuttleworth. The Council decided to ask Sir John Snell to carry out the proposed scheme of extension of the power station, and to state his terms for doing so. The proposed scheme will involve a total expenditure of about £240,000.

London.—BETHNAL GREEN.—PRICE INCREASE.—The Electricity Committee has recommended the B.C. to increase the price of electricity from the present increase of 33⅓ per cent. to 50 per cent. on the pre-war charge.

Loughborough.—YEAR'S WORKING.—The gross profit on the past year's working of the electricity department was £5,274, and the net profit was £1,012. The output was 63 per cent. in excess of that of the previous year, constituting a record year's results. Total units sold were 2,566,826; revenue received, £14,222; works cost (units sold), '837d.; and average price received per unit (sold), 1·26d.

Lymington.—PRICE INCREASE.—The E.L. Co. has increased the price of energy from 7d. to 9d. per unit, but no consumer is to be charged more than 8d. without the consent of the Corporation.

Market Drayton.—STREET LIGHTING.—The U.D.C. has accepted the estimate of the E.L. Co. for the lighting of the street lamps at £2 5s. per lamp, or if only the 39 lamps used during the winter months were used, at £2 10s. per lamp.

Middleton.—YEAR'S WORKING.—The revenue of the T.C. electricity department increased by £2,547 during the past year, and the expenditure by £1,461. The number of units sold increased by 47,914. The loss on the undertaking for the year was £518.

Nelson.—WAGES.—The enginemen, firemen, &c., at the Corporation electricity works have given notice that unless they receive an increase in pay of 20s. per week on their pre-war wages, plus 12½ per cent., to date from March 21st last, they will cease work on July 10th. They are at present receiving 16s. per week above pre-war wage.

Pontypridd.—YEAR'S WORKING.—The annual accounts of the U.D.C. electricity undertaking for the year ending March 31st, 1917, show an income of £12,684, whilst the expenditure was £7,151.

Queensbury.—PROPOSED E.L. SCHEME.—The U.D.C. has deferred consideration of a request from the Yorkshire Electric Power Co. to support its proposal to supply the Queensbury area with electricity, for which the company intended to apply to to Parliament for sanction.

St. Austell.—All matters in dispute between the Urban Council and the Electric Lighting Co. have been settled by the acceptance by the latter of £100 per year for three years.

Stamford.—PRICE INCREASE.—The Urban E.S. Co. has decided to increase the charges for electricity from July 1st as follows:—For power and heating, by an additional 10 per cent. upon the present charge; for supply through slot meter, by an additional penny in the shilling on the present charge; weekly payment consumers, by an additional penny per week, except during the four summer months.

Stoke-on-Trent.—PROPOSED EXTENSIONS.—The E.S. Committee has recommended that the generating plant in the central power house be extended by the provision of a 5,000-KW. turbo-generator, boilers, &c., at an estimated cost of £100,000, with £10,000 for contingencies, and that an extra-high-tension main be laid from the central power house to Liverpool Road, at an estimated cost of £2,400. At a meeting of the T.C., at which the work of the department was severely criticised, consideration of the proposals was adjourned pending a report by Sir John Snell.

YEAR'S WORKING.—The total revenue of the electricity undertaking for the past year amounted to £65,663, an increase of £6,000 on the previous year, but the increased expenditure was nearly £9,000. The gross profit was £19,664, but, after providing for the redemption of loans and payment of interest, the net loss was £3,769, increased to £3,993 after paying for new meters out of revenue. The total debit balance is now £10,829. The loss is accounted for chiefly by the increased cost of coal and higher wages.

Sutton (Surrey).—PRICE INCREASE.—The South Metropolitan Electric Tramways and Lighting Co. has amended the tariff for electricity as from July 1st, as follows:—Lighting, 6d. per unit, plus 10 per cent.; power and heating, an extra ½d. per unit. The minimum charge is to be 13s. 4d per winter quarter, and 6s. 8d. per summer quarter.

Walthamstow.—YEAR'S WORKING.—At a meeting of the U.D.C., the chairman of the E.L. Committee stated that the profit on the undertaking for the past year was £1,144, compared with a loss for the previous year of £6,665. The income increased from £45,788 to £53,722, and the output increased by 828,000 units. In spite of the increased output, the cost of coal was £381 less, being 2·81 lb. per unit, against 3·07 lb.

Totnes.—PRICE INCREASE.—The Electricity Supply Corporation has applied to the B. of T. for consent to advance the price of electricity to 9d. per unit.

Wakefield.—PRICE INCREASE.—The Electricity Committee has increased the price of electricity by 1½ per cent. for each advance of 6d. per ton in the price of coal, and ½ per cent. for each advance of 1s. per week, or fraction of 1s., granted to workmen.

LOAN SANCTION.—The City Council has received the sanction of the L.G.B. to the borrowing of £6,000 and £958 for electricity purposes.

Weston-super-Mare.—PRICE INCREASE.—The E.S. Co. has advanced the price of energy on the flat and maximum demand rates by 1d. per unit, the latter to apply to the low-rate units, and by ½d. per unit for heating and power.

Weybridge and Walton-on-Thames.—PRICE INCREASE. The Urban E.S. Co. announces that from the quarter ending September the price of energy for power and heating will be advanced by 10 per cent.

Wolverhampton.—PRICE INCREASE.—The E.S. Committee recommends that after the June readings the charge for the supply of electricity to all ordinary consumers not under contract be further increased by 10 per cent., making a total of 60 per cent. over pre-war charges.

TRAMWAY AND RAILWAY NOTES.

America.—STATE RAILWAY CONTROL.—The U.S. Congress has passed a Bill authorising the President to assume control of urban and interurban electric lines conveying workpeople to and from shipyards engaged on Government work. The Bill specifically excludes "any street or interurban electric railway which has as its principal source of operating revenue urban, suburban, or interurban passenger traffic or sale of power, heat, and light, or both."

Burnley.—YEAR'S WORKING.—The Corporation tramway department has made a profit for the past year of £6,389. This has been placed to the reserve fund, which now amounts to £34,196.

Ilford.—SANDBERG PROCESS.—The Tramways Committee has decided to have 50 joints in its tramway track treated with the Sandberg oxy-acetylene rail-hardening process, at a cost of £2 per joint.

Liverpool.—STRIKE.—According to the *Evening News*, a large number of tramway workers struck work on Tuesday, dislocating the service.

In the early morning the conductresses on strike held up munition workers' cars, pulled conductresses who were at work off their cars, threw mud at the drivers, cut the trolley ropes, and broke some of the windows of the cars. The strikers demand an arbitration board, comprising five representatives of the Tramways Committee and five employés, with a neutral chairman, and also the same pay for a 48 instead of a 60 hours' week.

London.—L. & S.W. RAILWAY.—It is announced that as from July 22nd the L. & S.W. Railway Co. is entirely abolishing its second-class rail bookings. Holders of second-class season tickets expiring after July 21st will be given the option of exchanging to first class by a proportionate payment, or should they elect to travel third class a *pro rata* allowance will be made. It is intended to convert the existing second class stock to third class as soon as possible; meanwhile, second-class carriages after July 21st will be available for third-class passengers.

Pontypridd.—ANNUAL ACCOUNTS.—The working of the U.D.C. tramway undertaking for the year ending March 31st, 1917, resulted in a gross profit of £6,843. The income amounted to £23,989, and the working expenses to £17,142.

Walsall.—YEAR'S WORKING.—The net profits of the Corporation tramways, including motor-'buses, for the past year, amounted to £16,515. It has been decided to appropriate £5,000 to the relief of rates, to put £4,895 to a special reserve account for motor-omnibuses, and to carry forward £6,620.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—The Secretary of State of the German Post Office said in the Reichstag, on introducing the Budget:—"The construction of new lines for telephone and telegraph traffic is, unfortunately, not possible owing to the lack of building materials and staff. The heavy snowstorms and hard frosts of this winter have disturbed telegraph and telephone working worse than has been the case for a long time. Only by bringing up all available forces, and by military help, has it been possible to repair the heavy damage. It is apparent that our open wires are insufficient, and that it will be necessary, after the war, to extend the cabling of at least the main trunk lines on a regular plan. After the war, moreover, automatic and semi-automatic working of telephone traffic must be again extended."—*Telegraph and Telephone Journal.*

Largest Wireless Station?—Buenos Aires reports that the wireless station there will be the biggest in the world. It includes three gigantic towers approaching in size the Eiffel Tower. —*Wireless Press.*

Post Office Employés.—The Postal and Telegraph Clerks' Association has decided to affiliate with the Labour Party. —*Evening News.*

Secret Wireless.—A very grave feature of the sinking of the hospital ship *Llandovery Castle* is the strong circumstantial evidence that the U-boat had been advised by wireless of the vessel's sailing. It has always been strongly suspected that the Germans still have secret wireless stations on the Coast of America. —*P.M. Gazette.*

Sweden.—According to the *Economist*, the Swedish Government proposes to acquire the Stockholm Telephone Co. It is said that the deal will be advantageous to the shareholders, but that, on the other hand, the public is likely to suffer, as telephone charges will be considerably enhanced.—*Telegraph and Telephone Journal.*

Telegraph Delays.—Complaints have appeared in the daily Press regarding serious delays that have been experienced in the transmission of inland telegrams, the time occupied in some cases exceeding that taken by train or tramcar to cover the distance. The delays are officially attributed to the influenza epidemic, depletion of staffs, and the shorter hours during which telegraph offices are open.

United States.—A joint appeal of the Secretary of Labour, Mr. Wilson, and Mr. Samuel Gompers, President of the American Federation, has been successful in preventing a nation-wide telegraph strike. Mr. S. J. Konenkamp, President of the Commercial Telegraphists' Union, in postponing indefinitely the "walk-out" voted by an overwhelming majority of the men, after the Western Union had refused to abide by the decision of the Taft Labour Board, relies upon prompt action by Congress to give the President authority to take over the telegraph and telephone systems. The Administration, while desirous of obtaining the specific approval of Congress, holds that the President has already legal authority to take over the lines as a war measure.—*The Times.*

Wireless Operators on Board Ship.—At the meeting of the Marconi International Marine Communication Co., Ltd., last week, the chairman said that the recent threat of the wireless operators to strike was due to the delay of the Ministry of Shipping in agreeing to an application for authority to increase the wages of operators. Although the latter were employed and paid by the company, their remuneration was provided by an agreed subsidy from the shipping companies, and without the concurrence of the shipowners the Marconi Co. could not deal with any question of increased pay, except on its own responsibility. The company had conferred with the representatives of the Association of Wireless Telegraphists, and a complete agreement had been arrived at.

Referring to the heroism of the wireless operators, Mr. Isaacs described, as a typical example, a case in which, after the operator on board a ship attacked by a submarine had obtained a promise of immediate assistance from a land station, he refused to leave his post, because he hoped to get into communication with a ship nearer at hand, although his ship was being shelled, and he was in a very exposed position. He was killed by a shell at the moment when he had attained his object, and the ship, with its crew of 45, was, in fact, rescued by the American cruiser which he had summoned at the cost of his own life.

CONTRACTS OPEN AND CLOSED.

OPEN.

Gillingham.—July 22nd. B.C. One 640-B.H.P. combined Diesel engine and alternator. See "Official Notices" to-day.

London.—L.C.C.—The Highways Committee recommends that tenders be invited for the supply of field coils, machined bronze bearings, armature coils, plough carrier brackets, magnetic brake coils, and accumulators for use in the tramways department.

CLOSED.

Australia.—NEW SOUTH WALES.—P.M.G.'s Department:

4 miles 330 yd. paper-insulated lead-covered conductor cable, 800 pairs £1,572 per mile; 1,540 yd. paper-insulated lead-covered conductor cable 600 pairs, £1,202 per mile; 2 miles 1,100 yd. paper-insulated lead-covered conductor cable, 500 pairs, £1,004 per mile; 4 miles, 880 yd. paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile; 1 mile submarine telephone cable, 7 pairs, £500 per mile; 880 yd. submarine telephone cable, 14 pairs, £709 per mile.—Western Electric Co., Ltd.

VICTORIA.—P.M.G.'s Department:—

8 miles 184 yd. paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile.—Western Electric Co., Ltd.

QUEENSLAND.—P.M.G.'s Department:—

1 mile 140 yd. paper-insulated lead-covered conductor cable, 800 pairs, £1,572 per mile.—Western Electric Co., Ltd.

South Australia.—P.M.G.'s Department :—

916 yd. paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile; 880 yd. silk and cotton-insulated switchboard cable, £274 per mile; 3 miles 300 yd. paper-insulated lead-covered conductor cable, 75 pairs, £398 per mile.—Western Electric Co., Ltd.

Western Australia.—P.M.G.'s Department :—

1 mile 92 yd. paper-insulated lead-covered conductor cable, 800 pairs, £1,572 per mile; 1,179 yd. paper-insulated lead-covered conductor cable, 600 pairs, £1,202 per mile; 1,280 yd. paper-insulated lead-covered conductor cable, 500 pairs, £1,004 per mile; 2 miles paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile.—Western Electric Co., Ltd.

The above are subject to adjustment for any variation either up or down in the prices of copper, lead, tin, antimony.—*Tenders.*

Bradford.—Electricity Committee. Recommended tenders :

C. A. Parsons & Co., Ltd.—12,000-kw. turbo-generator.
J. Wolstenholme & Son, Ltd.—Circulating water pipes and "specials."
Mirrlees Watson Co., Ltd.—Air pump and water extraction pump for auxiliary condensing plant.
Stewart & Lloyds, Ltd.—Steam pipes for new turbo-generator.
Holden & Brooke, Ltd.—Vertical-spindle motor-driven centrifugal pump.
Hick, Hargreaves & Co., Ltd.—Surface condensing plant for Valley Road works.
Thwaites Bros., Ltd.—Air exhauster in connection with the suction ash plant.

Tramways Committee :—

Hadfields, Ltd.—Point fittings at schedule prices.

Cape Town.—Corporation. Electric light wiring of the extension to the Early Morning Market, Sir Lowry Road, viz :—

C. H. Pead (accepted)	**£192**
Edward A. Shaw & Co.	197
R. G. Jack	228
Cunningham & Gearing	249
Gilmour & Co.	265

Cavan.—Messrs. Ferguson & Co., Dublin, have secured the contract, at £2,172, for the installation of electric lighting in Cavan Workhouse.

London.—The Metropolitan Asylums Board has accepted the following tenders :—Electrical Contracts and Maintenance Co., Ltd., installation telephone switchboard, £248; Keith & Blackman, Ltd., electric fan, £27, (less cost of fixing by the Board's own staff).

The Metropolitan Water Board has accepted the tender of Pope's Electric Lamp Works, Ltd., for electric lamps for 6 months.

Newcastle-under-Lyme.—Accepted tender :—

One 150-kw. converter and necessary high and low-tension switchgear.—British Westinghouse Co., Ltd., £2,107.

New Zealand.—Public Service Stores, Wellington :—

700 extension bells, 1,000 ohms, and 500 6-conductor cords, mounted, £90.—Richardson, McCabe & Co., Ltd., £473; 100 sounders P.O. pattern, £237.—P. R. Baillie & Co.; 2,000 switchboard plugs, £275.—A. D. Riley & Co., Ltd.; 10,000 galvanised telegraph arm combiners, £291.—P. & D. Duncan, Ltd.—*Tenders.*

Sheffield.—Electricity Department :—

Dewsburst's Engineering Co., Ltd.—250 steel boiler tubes; Cole, Marchent and Morley, Ltd.—Eight new valves and spindles.

Health Committee :—

Edison Accumulators, Ltd.—Two British built chassis.

Walsall.—T.C. Electricity Department. Accepted tenders :

Brush Electrical Engineering Co., Ltd.—Two 350-k.v.a. transformers, and one 100-k.v.a. transformer, £929.
British Westinghouse Co., Ltd.—Three switch cubicles for the above transformers, £345.
W. Wistance, Ltd.—Work in connection with use of canal water for condensing purposes at Birchills generating station, £150.
Cross & Cross, Ltd.—Steel carrier for conveying main across canal, £168.
Vacuum Oil Co., Ltd.—700 gallons transformer oil.

Wolverhampton.—Electricity Committee :—

Staveley Coal & Iron Co.—20 tons of flat c.i. plates, £7 15s. per ton.
Gibbons, Bros.—Platform, hand-railway, stairway, and ladder for the second 5,000-kw. turbo set, £220.
Siemens Bros.—Two e.h.t. switch panels, £160 and £165.

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—Friday, July 12th. At 3 p.m. At Caxton Hall, Westminster. Annual Congress.

Junior Institution of Engineers (Midland Section).—Saturday, July 13th. Visit to Ocker Hill Pumping Station. Meet at Snow Hill Station, Birmingham, at 1.50 p.m.

Electrical Power Engineers' Association (Northern Division).—Thursday, July 18th. At 7 p.m. At the Grosvenor Hotel, Deansgate, Manchester. General meeting.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 82 of the Electrical Review, which will be printed in the course of a few weeks, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d., post free. Any reader or advertiser at Home or Abroad, who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to the Publisher, Electrical Review, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Channel Tunnel Approved.—The International Parliamentary Commercial Conference, representing all the Allied countries, on July 4th unanimously adopted the following resolution, after a paper had been read by Sir Arthur Fell, M.P., on the commercial advantages of the Channel Tunnel :—"Considering the advantages which would accrue from increased facilities for the transport of passengers and goods between France and Great Britain, this conference suggests to the Governments of those countries that the construction of the Channel Tunnel should be proceeded with as soon as possible."—*Evening News.*

Fruit Drying by Electricity.—According to the Bulletin of the Swiss Association of Electricians, the drying or evaporation of fruit and vegetables by electrical means has been successfully accomplished in Switzerland. Trials carried out at the instance of the Government of various apparatus showed that electric evaporation apparatus could compete with those using coal only when the price of energy did not exceed 3 to 4 centimes per kw.-hour. Such a price was only possible with the hydro-electric companies' surplus energy, and fortunately in 1917, in the period of "high water," a considerable surplus was available during the night, which allowed of its supply at the price named. Some companies even, for patriotic motives, agreed to supply current at a lower price, the works of the Canton of Barich offering it during the night only at 1 centime per kw.-hour. Others have gone beyond this even, and decided to supply their customers with energy during the night gratuitously.

Educational.—Manchester Municipal College of Technology (University of Manchester).—The session 1918-19 opens on October 3rd. Matriculation and entrance examinations will be held in July and September. Matriculated students may enrol for 1918-19 from August 1st, 1918, and if under 18 years of age are eligible for membership of the O.T.C. Further particulars are given in our advertisement pages to-day.

The Storage of Coal.—Although the storage of coal has become of unusual importance under war conditions, it should not be considered only as a war expedient, and plans for storage should be made in connection with every industry that uses coal as one of the adjustments necessary to stabilise a fundamental industry of the country. An abstract of an unusually valuable paper, which was read before the Western Society of Engineers, Chicago, on April 15th, by Mr. H. H. Stock, on why coal should be stored; the practicability of storage and effect of storing on the coal; systems of storage employed; cost per ton and precautions to be observed, appears in *Power* (Vol. XLVII, No. 23). A reason often advanced against storage is the increased cost involved, but a suitable readjustment of mining and transportation conditions should mean a lower cost for mining and transportation that would, at least partly, offset the additional necessary cost for storage, and should not increase the cost to the consumer much, if at all.

Electric Welding for Ships.—The electric welding tests being conducted by the Emergency Fleet Corporation at the Federal shipbuilding plant at Newark, New Jersey, are the subject of a report made by Mr. Mason, who is directing the tests, the objects of which are to demonstrate the economy of welding in time and money, and its adequacy to build a staunch ship. Mr. Mason says that electric welding in its various phases has for years been employed in shipyards, and the proposal to extend its use to the major part of ship construction has met with gratifying approval from the shipbuilder. It has been necessary to design a ship to suit the material available, without encroaching on that needed for the regular ship construction at the plant. The hull will have the outline, dimensions, and strength conforming to the ships the Federal company is building.

Briefly, the programme is to assemble a hull rapidly by spot welding. The structure then becomes a house favourable for work in all weather and at night, in which the completion of the ship may go on. After the material is thus assembled, so that it is sufficiently strong to hold its shape, the work is completed by arc welding all seams. Roughly, the spot welds are to be about 10 in. (25·4 cm.) apart.

One quarter of the structure will be riveted, the other three-fourths welded, so that the tests of strength will afford a basis of comparison.

Electric welding offers a great field for lightening a ship. In this design various views of this opportunity will be tried out; ultimately 10 per cent. of the steel may be eliminated.

The manufacture of the spot-welding yoke and appliances is placed in the hands of the Universal Electric Welding Co. of Long Island City. The early stages of the arc welding are to be accomplished by the Wilson Electric Co., which was so successful in the work on the German ships' repairs, but it is the intention to call in all men with ideas and apparatus, and to give them a field to test out in actual work. To this end Prof. Adams's Committee is searching out all available talent.

An adequate system of testing the work when done is under consideration. The primary test will consist of filling the hull with water and shifting the points of support under continual and close scrutiny; as one-quarter of the whole will be riveted in the normal manner, there will always be a gauge of comparison between this portion and the portion which is welded. Likewise, there will be a chance for comparison of the two forms when subjected to abuse by bumping with rams and in various other ways.

Machine Tools and their Electrical Gear.—One of the questions still to be seriously tackled by machine tool builders is the design of direct-coupled motor-driven machines. At present the motor and switch gear cannot be said to be in any way incorporated in the design of the machine. Indeed, not infrequently they are attached in a way which at first sight suggests that the job has been done by the erectors and not by the drawing office. This is not unnatural with small tools. It applies particularly to control switchgear, and is the case not only with medium-sized machines, where the design is usually standardised for belt-driving, but with the largest machines. Rarely does the motor and switchgear seem part of the general design of the machine. The best direction for the solution of the problem would now seem to be the use of more or less standard motors but with improved attachment between motor and machine tool. The incorporation in the design of control and switchgear generally leaves even more to be desired. Present-day control gears with push-button control afford special means for increasing the handiness of the machines. This is particularly true of large machines. They can be controlled from two or more stations electrically in a much simpler manner than if the control were mechanical. The tendency at present, however, seems to be to use the control levers and shafts which serve for a belt-driven machine, and simply attach the switches thereto. In many cases it would seem possible to install simple switches near the point of application of the movement, and to transmit the power electrically. It is recognised that all controllers should be as close as possible to the working position of the operator. The difficulty, especially in large machines where the working position is movable, is to provide suitable connections between the controller and the motor. As this implies usually multiple-cored cable, and bare conductors are not allowable, provision is necessary for taking up any slack in the cable and avoiding the insulation being frayed against sharp edges or destroyed by trapping between moving parts of the machine. The investigation of the possibilities of electrical apparatus would certainly be quite profitable to machine tool designers, especially those connected with the larger machines.—*American Machinist.*

Sports Meeting.—The London Munitions Workers' sports are to be held on the Herne Hill track on Saturday, July 27th, at 3 p.m. In connection with this sports meeting a very varied programme has been arranged, including four handicap events, eight scratch races, and several novelty items. Of the last named, the ladies' tug-of-war should be well worth seeing. Entries have to be sent in not later than July 15th, and full particulars may be obtained from the Hon. Sports Secretary, 24, Great Russell Street, W.C. 1.

Canadian Water Power.—"Water Resources," Paper No. 20 of the Dominion Water Power Branch of the Canadian Department of the Interior, which has just come to hand, deals with the interests dependent on power derived from the Winnipeg River. The City of Winnipeg, although in the "Middle West," remote from other large centres of population, and from the sources of many raw materials, ranks as the fourth manufacturing city in Canada; between 1900 and 1915 the capital invested increased by 1,480 per cent., the value of its products by 1,770 per cent., and the persons employed by 637 per cent., while the cost of power diminished by 76 per cent., the last being a most important factor in the development of the city and its industries. Cheap hydro-electric power has superseded practically all the private fuel power plants; apart from lighting, heating, and traction, the total hydro-electric power connected is 66,740 H.P., and the fuel plants constitute only 3 per cent. of the total. The city is at the meeting of five railway systems, and is the gateway to one of the greatest markets in the world.

The total capacity of the Winnipeg hydro-electric plant at Point du Bois in 1915 was 47,660 H.P. The total capital expenditure was $7,339,538, the total revenue $976,854, and the gross balance $648,972; after paying interest, sinking fund and depreciation, there remained a net surplus for the year 1914-15 of $79,191, practically wiping out a deficit in the earlier years of the undertaking. The capital outlay was about $150 per H.P. installed: additional plant of about 57,760 H.P. is being installed, which will bring down the capital cost per H.P. very considerably. The peak load in 1914-15 was 25,400 H.P., the number of consumers 32,953, and the KW.-hours generated, 70,743,274.

The report deals in detail with the Winnipeg Electric Railway Co., which has hydro-electric plant of 22,500 H.P. and steam plant of 22,000 H.P., and carries 58 million passengers a year, besides supplying light and power, the total connected load being over 99,000 H.P. A number of smaller undertakings in the district are described in the report, which also gives a quantity of economic information. In 1914 about 136 million KW.-hours were actually sold or used. The capacity of the river with full regulation is equal to a peak load of 836,000 H.P., and the total peak load in 1914 was 64,300 H.P.; allowing for an annual increase of 8 per cent., the whole power of the river will be required in Greater Winnipeg alone in 30 years.

Corrosion of Cast-Iron.—The experimental work done for the purpose of a report upon the corrosion of cast iron water mains laid only two years previously in the soil at Esch, in the Grand Duchy of Luxemburg, is described by P. Medinger in the *Journal für Gasbeleuchtung*, February 16th:—

The pipes had become as soft as hardwood, and could be cut with a clasp knife. An analysis of the original metal showed metallic iron 92·64 per cent., carbon 3·42 per cent., while that of the corroded pipes showed metallic iron varying from 30·5 per cent. to 44·2 per cent. only, and carbon 24 per cent. When the pipes were first taken up little or no rust was visible, but the iron had been changed into a powdery metallic form. The pipes were laid in yellowish-grey heavy loam, in which there was a good deal of gypsum; the loam contained 7 per cent. of calcium bicarbonate and 19 per cent. of water, which held in solution 2·05 gm. of calcium sulphate per litre; there was scarcely any chlorine present.

From elaborate electrical tests the author proved that a difference of potential as low as 0·5 volt produced between the carbon and the iron would cause a flow of 0·8 milliampere through the pipe, and he attributes the rapid deterioration to the electrical action in the presence of the electrolyte formed by the solution of the salts in the soil with rain water. This solution is kept in permanent contact with the pipes owing to the retentive character of the soil.

A New Application of Electrolysis.—A new small industry has just been started in Valencia, Spain. In the Valencia district a large number of small decorative articles are manufactured in clay, wood, glass, and *papier-maché*, and some of these are now being encased in a thin "skin" of metal, which greatly improves the appearance and permanence of the articles.

The method employed is simple. A small compressor supplies air at a pressure of about seven atmospheres to a receptacle filled with metallic powder (generally lead, for cheapness). At the moment the metallic powder emerges from the jet, it is melted by an oxy-hydrogen flame, and a spray of molten metal encases the object to be "metallised," which is placed on a revolving platform. The object then goes to the electrolytic bath, and receives its new skin of copper, silver, or gold. Glass articles are first treated by a sand-blast to ensure the necessary roughness for the adhesion of the lead. A new type of Leyden jar is being manufactured, in which the old silver-foil is replaced by a homogeneous film of silver.

The firm of Arturo Piera, Valencia, is the Spanish pioneer in this class of manufacture, and is already supplying a large number of carvings, lamps, candelabras, and statuettes for interior decoration at Madrid.—*La Energia Eléctrica.*

The Batti-Wallahs.—On Monday, after a lapse of 18 months, 40 members of the Batti-Wallahs' Society attended a lunch meeting at the Holborn Restaurant. Past-President L. M. Waterhouse was in the chair. It was decided that a further lunch be arranged for Monday, September 16th, to be followed by similar functions on the third Monday of each subsequent month.

Charges for Public Services.—Moving the second reading of the Statutory Undertakings (Temporary Increase of Charges) Bill, Mr. Wardle said it had been framed to give effect to the recommendations of Select Committees appointed to consider the case of gas and tramway undertakings whose position had been adversely affected by the war, and its provisions applied also to water and electricity supply undertakings. In the case of companies, intervention was not to take place until the dividend on the ordinary stock or shares had been reduced to half the standard or maximum rate, or half the average dividend for the three years before the war, whichever were the smaller; the sliding scale or maximum charge would then be suspended, and the company could charge such prices as might be held by the Board of Trade sufficient to cover costs of production and to pay a dividend at the rate above mentioned. In the case of municipalities, the prices might only be increased sufficiently to prevent loss, and not in any event more than 50 per cent. The Bill was to have effect for two years after the end of the war.

Strong exception was taken to the proposals in various quarters on the ground that the relief given was almost negligible, capital could not be obtained except on ruinous terms, and that the gas companies were subject to competition. The motion was agreed to, and the Bill referred to a Committee of the whole House.

Writing to the *Financial Times*, Mr. T. W. Cole, secretary to the Provincial Electric Supply Committee of the United Kingdom, points out that:—"Up to the present the statutory rates for electric supply embodied in the various Provisional Orders of the companies can be raised by the Board of Trade every five years on application by the company provided proper grounds are shown for such revision. The arrangement has in general worked satisfactorily to all parties. This Bill, however, curtails the power of the Board of Trade, and allows it to grant such increases (if war losses are the plea—which, of course, includes practically all present day cases) only if the dividends are falling below one-half of the pre-war figure. And then the increase must only be sufficient to bring the dividend up to half the pre-war dividend. In other words, Parliament is taking the position that whatever are the war losses of a company, the shareholders must be content to lose half their income. Further, considering that the electric supply industry is a 'key industry' (in the words of a Board of Trade Committee) and that the money of the shareholders is performing a national service (and especially in view of the fact that munitions works and factories generally which are making big profits are dependent on the supply company for the power) it is most inequitable that such shareholders should have no redress until they are half ruined, so to speak. It is the more deplorable since the electric supply shares are held usually as permanent investments by small holders who depend on the same for their incomes or part incomes. The fact that their money is invested in national and public 'utility works' should itself entitle them to protection, whereas apparently they would be better off if they held investments in one of the much-deprecated 'luxury trades.'"

Measuring Rapidly Varying Temperatures.—Ordinary thermometers are too sluggish to follow rapid variations of temperature. It has recently been possible to construct apparatus by which variations of temperature with a frequency as great as 10 times a second may be measured. The changes of temperature in the cylinders of steam engines or explosion engines can thus be measured. The temperatures are recorded on a galvanometer connected to platinum-iridium wires of 0·02 mm. diameter consisting of 65 parts of platinum and 35 parts of iridium, the deflection depending on the resistance of the wires, and, therefore, their temperature. These wires can be used up to a temperature of 1,850° C.—*Elektrotechnik und Maschinenbau.*

Extinction of Fires in Transformers.—The firm of Wintrich & Goetz, Bensheim, has designed an automatic apparatus for extinguishing fire, that is particularly adapted for use with transformers, oil switches, &c. The apparatus is in many respects similar in appearance and design to the "Minimax" fire extinguisher, from which it differs in the method of producing the pressure to eject the fluid from the interior and in the nature of the fluid used. Instead of producing the gas pressure by a chemical reaction, a small container containing compressed nitrogen is screwed into the top of the apparatus. This gas is released by striking a knob, which in turn hits a sharp pin that punctures a disk that closes the gas container.

The fire-extinguishing liquid seems to be a volatile incombustible carbon compound, which by its volatilisation withdraws heat so rapidly from the conflagration that further combustion is impossible. The liquid is perfectly non-conducting to electric currents, as has been shown by tests at 40,000 volts, in which the jet was projected against an arcing horn discharger.

In order to render the apparatus automatic in its action, it is set up so as to feed a pipe-line running through the various transformer and switch chambers to be protected. In each chamber two outlets from the pipe are provided, one near the ceiling over the apparatus, and one near the floor. Both these openings are closed by fusible plugs. Connected to the upper opening by a fusible wire is a weight. If the temperature at the top of the chamber rises owing to a conflagration, the fusible plug and the fusible wire melt; the first opens the passage for the extinguishing fluid, and the second releases the weight. This releases a cam holding a weight suspended above the fire extinguisher. This weight falls on to the knob that punctures the gas container, and the fluid is forced through the pipe-line and is poured over the centre of the fire. If burning oil overflows on to the floor in any of the chambers, the lower fusible plug opens, and the liquid issues from this outlet as well as from the one in the ceiling.—*E.T.Z.*

Lignite as Fuel.—Previously to the outbreak of war, Germans were experimenting in Devon on the utilisation of lignite for generating power. The lignite deposit is in the Bovey Tracey basin. In March, 1914, Dr. Lambrecht, the leading mineralogical adviser to the German Government, submitted a report to the Deutsche Bohrgesellschaft, on the property and works, in which he referred in the highest terms to the results and prospects of generating electrical energy at very low cost. This view is confirmed by an experienced English mineralogist, and though the lignite has the great disadvantage as fuel of being high in sulphur, valuable by-products could be obtained from it.

The Controller of Coal Mines has issued a circular in which he directs attention to the importance of developing the resources of any alternative kinds of fuel, in view of the drastic economy in the use of coal which is necessitated by the release of miners for service in the Army, and the increasing demand of our Allies. Peat which is not cut by the end of July is not likely to be in fit condition for use during the winter. In the circular directions are given as to the method of cutting, drying, and preparing peat for fuel.—*The Times.*

Possibilities of the Electrochemical Load.—At a recent meeting of the new-business men of the Ohio Electric Light Association, C. A. Winder, of Niagara Falls, discussed the possibilities of this load from the standpoint of the average company. In considering the power consumption, Mr. Winder pointed out that aluminium consumes the largest amount of power per lb. of finished product, approximately 12·5 KW.-hour, and is extremely dependent upon the low cost of power. Aluminium manufactories may exist a thousand miles from the centre of gravity of distribution, provided that energy can be obtained at $20 to $25 per KW.-year. Artificial abrasives are next, with an energy consumption per lb. of product of about half that for aluminium. The weight of finished material, however, is high, so that if the haul of the finished material were 2,000 miles (3,218 km.), it is doubtful if an artificial abrasive plant could exist if power were free. Under the prevailing price of water power a 500-mile haul is given as a maximum. Calcium carbide, ferro alloys, sodium, chlorates, and phosphorus are stated to be in practically the same position as artificial abrasives—namely, all require power at the prevailing water-power rates and within close proximity to the centre of gravity of their consumption.

Ferro-silicon, from an engineering standpoint, can be made economically under normal circumstances in furnaces of about 10,000-H.P. input, and the author states that apparently those companies now entering this field are planning on small furnaces. Such engineering, however, it is pointed out, cannot withstand the rigours of competition that will follow the war, the product now being very high in price. Low frequency is a prime requisite to the successful operation of ferro-alloy, calcium carbide, and similar furnaces.

It is stated that if we consider off-peak power for such loads as artificial abrasives, ferro-alloys, and calcium carbides, it is found that an 80 per cent. load factor will so greatly increase the overhead costs that the power will have to be obtained without any cost at all to be attractive. Daily off-peak power for a carborundum furnace is absolutely out of the question, as the carborundum furnace operates for 36 hours. Neither, for the same reason, can the graphite furnace be considered. Valley power coming in periods of eight months is of economic possibilities that are not attractive to the average electrochemical industry.

The smallest user of power per ton output is, perhaps, the caustic and chlorine industry, and it is, consequently, the most affected by long freight hauls. Therefore these materials are manufactured near the market, and are two of the few electrochemical industries that the central station, perhaps, may hope to attract. The only difficulty is primarily one of rates.

The only classes of power users that the modern central station in large cities should solicit are japanning ovens, brass-melting and steel-melting furnaces where good scrap is available and other conditions correct, as well as industrial power-consuming devices. —*Electrical World.*

British Patents for German Inventors.—In the House of Commons Sir Albert Stanley, in answer to Sir E. Carson, who asked whether patent agents were allowed to enter into communication with and receive communications from inventors in Germany who desired to protect their inventions in this country by filing specifications in the Patent Office, said that patent agents were permitted to enter into and receive the communications referred to by general licence of the Board of Trade. Such communications were made through agents in neutral countries, and were subject to censorship in the ordinary way by the Postal Censor. Whether they should be allowed to continue was being carefully considered by the Government.

On a later occasion he stated that 1,310 applications for the grant of patents had been received from enemy subjects since the outbreak of war, of which 944 had been accepted.

Reconstruction in Industry: Whitley Councils.—The formation of Joint Industrial Councils on the lines of the Whitley Report is steadily progressing. Councils in the pottery and building industries are already at work, and during the present month the following newly-formed Councils will hold their first meetings:—The Heavy Chemical Trade, Gold, Silver and Allied Trades, the Rubber Industry, Match Manufacture, the Silk Industry.

In the following industries Provisional Committees have already drafted constitutions of proposed Industrial Councils, which have been sent out to the various Associations concerned for their approval:—Baking, Cable-Making, Commercial Road Transport, Electrical Contracting, Furniture Making, Leather Goods and Belting, Vehicle Building.

A constitution for the printing industry has been drafted, and will shortly be sent out for approval to the Associations concerned. When these constitutions have been approved, the first meetings of the newly-formed Councils will be arranged with as little delay as possible.

In the following industries preliminary conferences as to the formation of Industrial Councils have taken place, and proposals to proceed with the drafting of constitutions have been approved:—Bobbin Manufacture, Boot and Shoe Manufacture, Electric Power and Supply, Roller Engraving, Woollen and Worsted Industry.

In some 20 other industries the question of the formation of Joint Industrial Councils is being given careful consideration, and in a number of cases proposals to summon joint conferences of Employers' Association representatives and Trade Union representatives have been approved. There are many of the nation's industries, of course, in which the organisation on the side either of the employers or of the workers is not sufficiently representative as yet to admit of the formation of Joint Industrial Councils at once. In these industries the "Whitley idea" is being carried out by the formation of temporary bodies which are termed Interim Industrial Reconstruction Committees. They will deal with the many urgent problems attached to the re-establishment of their representative industries on a peace basis, and, in addition, will improve the organisation of their trades where it is at present unrepresentative. Later it is hoped they will be in a position to pass from their temporary nature, and become full Joint Industrial Councils. Towards the formation of these temporary bodies the Ministry of Reconstruction has already made considerable progress, and Committees have already been established in some 20 trades and industries. Fuller details of progress in this matter will be available shortly.

Fuel and Light Ration.—Commenting on the new Household Fuel Order, the *Times* points out that in converting from coal to gas or electricity some curious discrepancies arise. For instance, in the case of a householder having seven occupied rooms, who takes 5½ tons of coal, he can have either 18,750 cb. ft. of gas and 200 units of electricity, or 15,000 cb. ft. and 120 units, the latter being evidently much the worse alternative. The reason is to be found in the fact that in the lighting allowance 15,000 cb. ft. of gas is taken as the equivalent of only 240 units of electricity, whereas, when the coal allowance is converted into gas or electricity, 1 ton equals only 15,000 cb. ft. of gas but 800 units of electricity. Hence, if a man taking 6 tons of coal decides to convert ½ ton of it into gas and takes his lighting allowance half as gas and half as electricity, he gets 15,000 cb. ft. of gas and 120 units of electricity; but if he converts a ½ ton of his coal into electricity he gets 200 units, and the remaining ½ ton, together with all his lighting allowance taken as gas, gives him 18,750 cb. ft.

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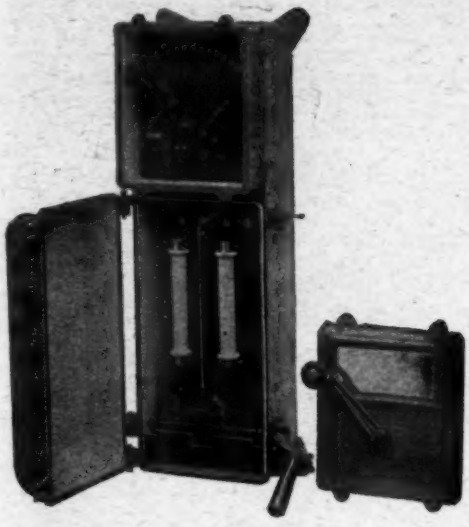

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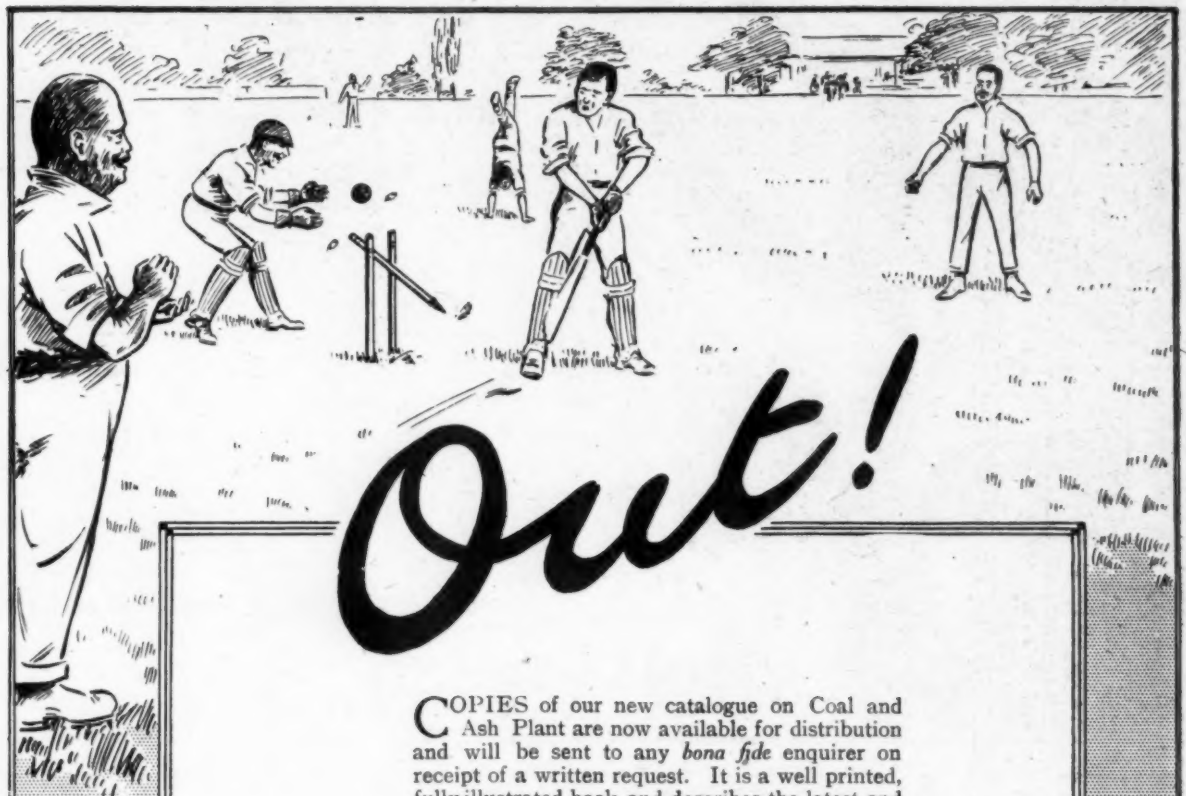

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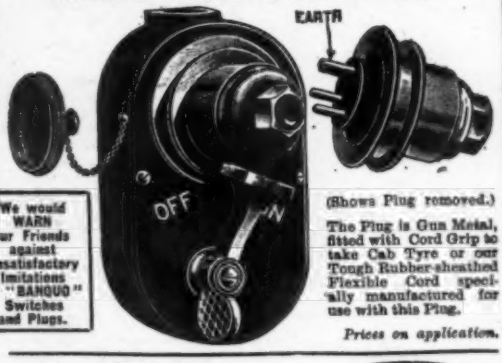

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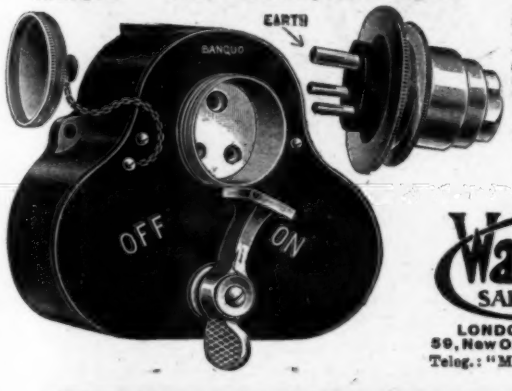

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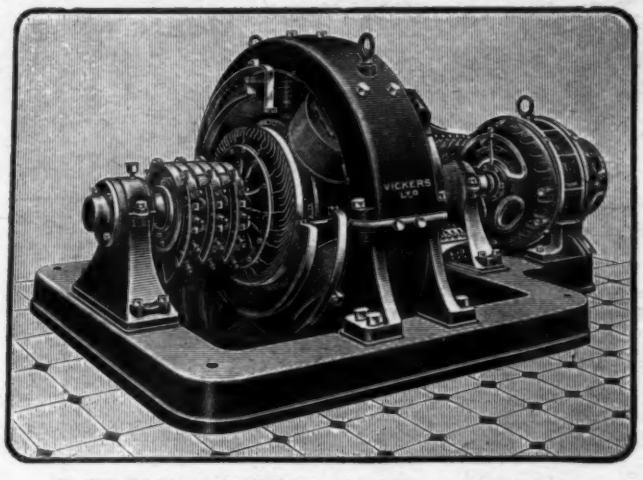

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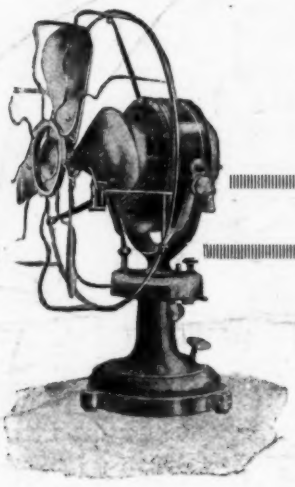

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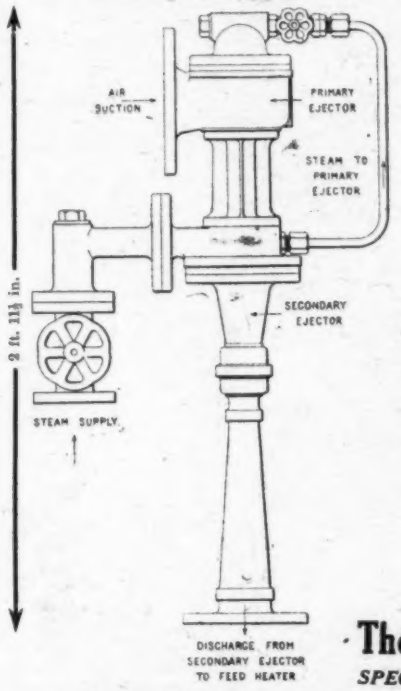

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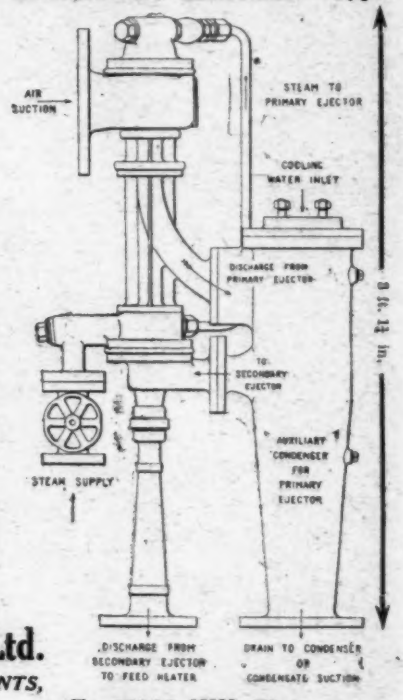
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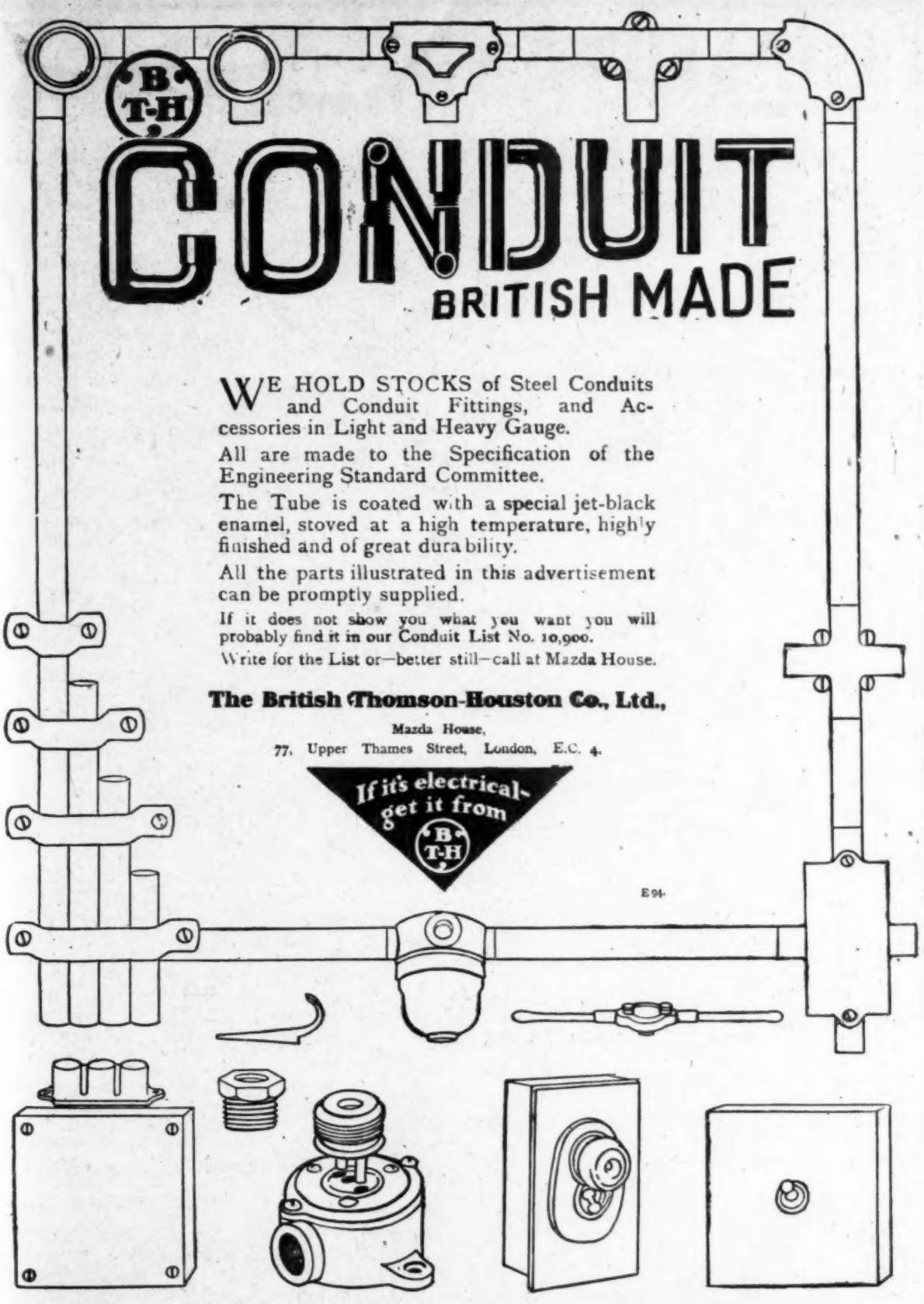

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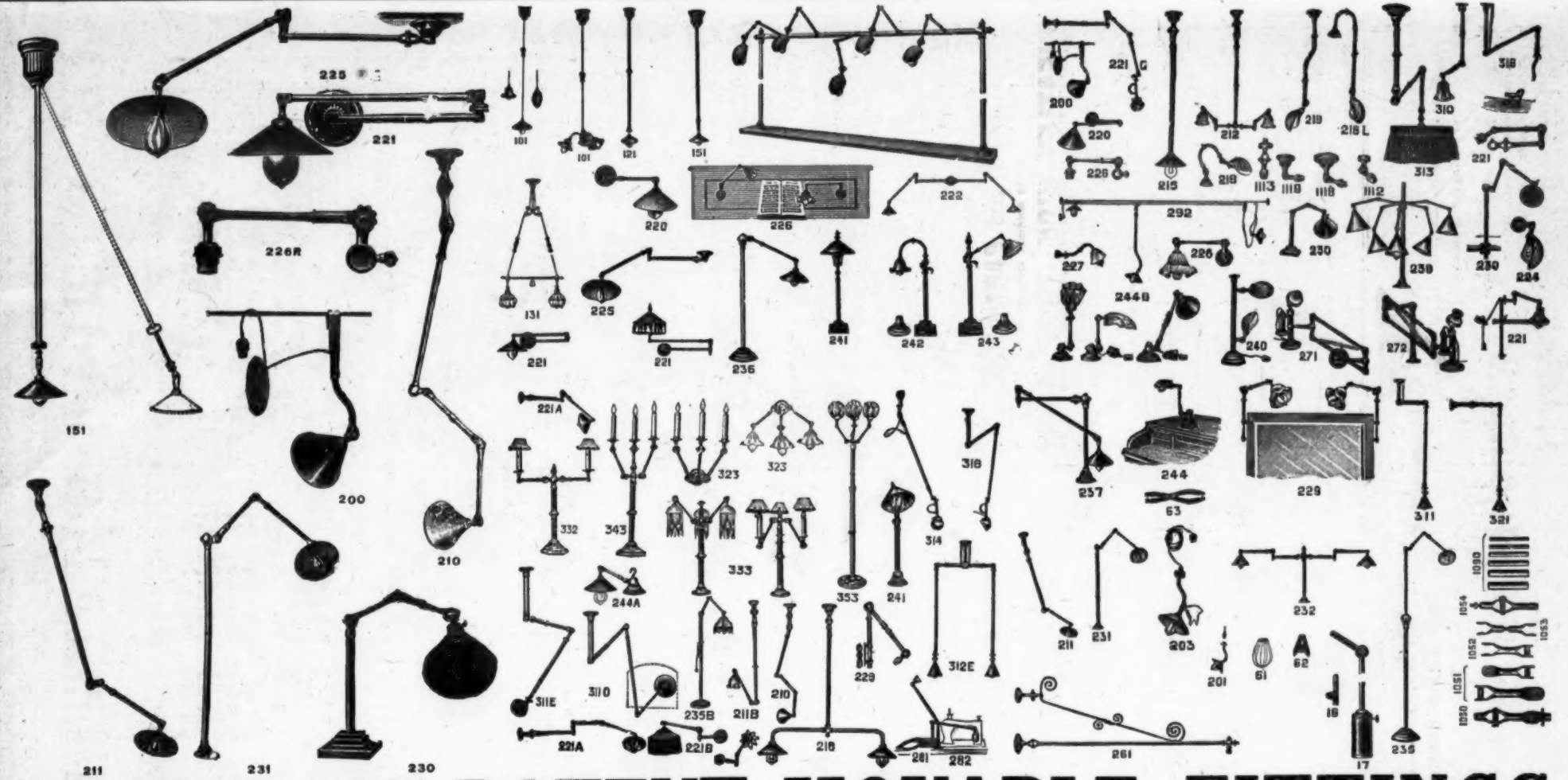

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ELECTRICAL

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can be obtained through

WHEATLEY KIRK, PRICE & CO.

(Established 1850).

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SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

CHARGE ENGINEERS.

CHARGE ENGINEERS wanted for Midland Power Station, experienced with turbines, water-tube boilers, and E.H.T. 3-phase. Salary £3 9s. per week, including all bonuses.

Apply, stating experience, age, and enclose copies of testimonials, to— 1933, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SITUATIONS VACANT.—*Continued.*

BOROUGH OF SWINDON.

Electricity Department.

WANTED, a Shift Engineer to take charge of a shift in a certified undertaking. The generating station supplies A.C., 3-phase, D.C. and tramways. Ljungstrom turbines and mixed pressure turbine. An up-to-date boiler house plant being put in. Wages £3 plus 8s. plus 12½ per cent. per week.

Applications, giving age and full details and experience and training, to be sent to the undersigned not later than July 21st.

A. DIMMACK,
Borough Electrical Engineer. 2038

FIRST CLASS FITTER.

WANTED, for certified undertaking, a first-class Fitter for general central station repairs, used to Belliss engines, B. & W. boilers, and Underfeed stokers; a permanent job for a suitable man. Wages, 57s. for 53 hours, plus 12½ per cent. bonus on total earnings. Apply—

CORPORATION ELECTRICITY WORKS,
7, Dorchester Street, Bath. 1960

ENGINEER-IN-CHARGE.

ENGINEER-IN-CHARGE Wanted for Power Station (certified undertaking); must be fully qualified man, with mechanical and electrical (E.H.T.) experience. Salary £182 per annum, inclusive.

Apply stating age, experience, technical training, military service position, &c., to—

1990, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

ASSISTANT ENGINEER.

ASSISTANT ENGINEER wanted at once for mains, meters, consumers, &c. Previous experience essential.

Apply stating age, experience and wages required, to BURGH ELECTRICAL ENGINEER, Stirling. 2013

FITTER.

FITTER wanted for public electric station, accustomed to repairs and maintenance of high-speed engines, boilers, &c., and usual central station repair work.

Apply stating age, experience and wages required, exclusive of 12½ per cent. award, to BURGH ELECTRICAL ENGINEER, Stirling. 2014

ENGINEER-IN-CHARGE.

ENGINEER-IN-CHARGE wanted for Diesel station. Applicants must be competent to cary out repairs, and have had A.C. experience. State experience and salary required, to MANAGER, Electricity Works, Staines. 1986

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

DRAUGHTSMEN.

DRAUGHTSMEN required by an Admiralty Department.
(*a*) Those with good general mechanical engineering experience;
(*b*) With good general electrical experience.

In both cases must be capable of preparing full working drawings from rough designs and sketches.

Apply, giving full details of training and experience, age, salary required and when at liberty, to—

2059, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

BURNLEY CORPORATION ELECTRICITY DEPARTMENT.

Junior Shift Engineers.

WANTED, Two Junior Shift Engineers accustomed to the running of E.H.T. 3-phase and D.C. Plant. Wages, including war bonus, £3 3s. per week.

Applications, with copies of recent testimonials, to reach the undersigned not later than WEDNESDAY, JULY 17th.

J. E. STARKIE,
Borough Electrical Engineer. 2048

MAINS ENGINEER.

WANTED Mains Engineer, to take charge of lighting mains, meters, and overhead equipment of a combined Electricity Supply and Tramway undertaking. Low tension three-wire network, and three-phase high-tension distribution. Applicant must have had previous experience of high tension supply and meter repairs. Permanent job to good man.

Salary £182 per annum to commence.

Apply stating age, experience, with copies of testimonials, to—

2064, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SUB-STATION ATTENDANTS.

SUB-STATION ATTENDANTS are required by a large Metropolitan Electricity Undertaking; experience with three-wire distribution and modern three-phase converting machinery essential. Wages to commence (inclusive of all bonuses), 56s. per week of six 8-hour shifts.

Apply, stating age (which should be over 25) and experience, to—

2044, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT required, wage 25s. per week, plus 20s. war advance, plus 12½ per cent. for seven 8-hour shifts per week. Shift off with pay every third week. Two weeks' holiday per annum with pay. D.C. and three-phase H.T. supply: steam turbines and reciprocators. Employment for duration of war. Previous electrical experience necessary.

Apply MANAGER, Corporation Power Station, Ipswich. 2018

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT required for an H.T. Power Station. Wages 35s. per week, + 15s. 6d. bonus, + 12½% for seven 8-hour shifts per week.

State medical category, age, experience, and enclose copies of testimonials, to the ENGINEER, Electricity Works, Redditch, Worcestershire. 2023

SWITCHBOARD ATTENDANT.

WANTED, Smart Youth, with previous experience, to act as Switchboard Attendant. Good opening to gain experience in three-phase E.H.T. and D.C. supply. Commencing wage 25s. per week. Apply, giving age, experience, &c., to—

R. B. LEACH,
Borough Electrical Engineer.
Loughborough. 2060

ASSISTANT ENGINEER.

ASSISTANT ENGINEER required for 3-wire D.C. station (certified undertaking); must have had experience in both power station and mains work.

Apply, stating full particulars of experience and salary required, to—

CHIEF ENGINEER & MANAGER,
Electricity Works, Leek, Staffs. 2006

SITUATIONS VACANT.—*Continued.*

SECRETARY WANTED.

SECRETARY required for large trade association; must be used to committee work and interviewing directors, and a good correspondent. Salary £1000 per annum to suitable candidate.

Applications should give details of past experience, together with recent testimonials,

1991, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
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A CONTROLLED Firm has vacancy for Assistant Manager for provincial branch. Thorough knowledge of estimating for electrical power, lighting and telephone contracts, and office organisation, essential. State salary expected, when free, and full particulars of experience. No applications will be considered from those already on Government work.—Apply to your nearest EMPLOYMENT EXCHANGE, quoting No. A5613. 1954

ACCUMULATOR Works General Manager, at once, with a good general knowledge of electricity. State salary. Reference. —C. A., 16, Waterloo Street, Birmingham. 5028

ARMATURE Winder for alternating and direct current repairs, only first-class man capable of dealing with all kinds of repairs and rewinding considered; Birmingham district. No one resident more than 10 miles away, or on Government work, will be considered.—State wages required and full particulars to 5042, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder required for electric railway shops, South London District. No one now employed on Government work will be considered.—Apply, stating wages required and full particulars, to 1969, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Engineer for small D.C. station. Must be low category or ineligible. Experience of Diesel engines essential.—Apply with full particulars to 1876, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANTS required to assist Engineer in large West End establishment. Must have a very good knowledge of electric power, lifts, and lighting installations, and be a fair draughtsman. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply stating age, experience and salary required, to 2045, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CAPABLE Foreman required for estimating and supervising installation work. Government contracts and private house work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, giving particulars of experience and salary required, to 4938, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer required. Applicants must be competent to carry out repairs on gas and Diesel engines, and have had experience with 3-wire system. Wages 50s. per week, including war bonus. Certified undertaking.—1939, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer required; must be fully qualified man with mechanical and electrical experience on 3-phase and D.C. system. Salary £2 8s., plus 20s., plus 12½ per cent. for seven 8-hour shifts.—Applications stating age, medical classification, training, when able to take up duties, to the BOROUGH ELECTRICAL ENGINEER, Wellington Road, Ashton-under-Lyne. 1984

CHARGE Engineer wanted for certified power station, Midlands A.C. and D.C. supply trams, destructor, batteries, boosters. Applicants must have had mechanical and electrical training; pay to commence 60s. weekly, including all bonuses to date.—Apply, with full details of age, experience, if married, present position and pay, when at liberty, to 2026, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CLERK, Costing and Invoicing, for London electrical contractor. Must be experienced. Applications treated in strictest confidence. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply stating age, salary, &c., to 2036, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

DRAUGHTSMAN.—Designer required, able to offer competitive designs in ironclad switches and switch fuses. No person resident more than 10 miles away, or already on Government work, will be engaged.—1961, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, experienced in Ship Electrical Installation work, required. State experience, age and salary. No person already on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2033.

DRAUGHTSMAN.—Wanted by electrical switchgear manufacturers in modern works near London, capable Assistant Draughtsman. Diagrams, designs developments under chief engineer, &c. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, stating experience and salary required, 1887, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN wanted for Jig and Tool work, also Draughtsman for Switchgear work (Tyneside). No person already on Government work will be engaged.—Apply stating age and salary expected to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2021.

DRAUGHTSMEN. Applications invited from first-class men experienced in any of the following classes of work :—(a) H.T. and L.T. switchgear ; (b) Detail mechanism ; (c) Motor control gear. Permanent and progressive employment. Manchester district. No one already on Government work need apply.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5652, and stating age, experience and salary required. 2030

DRAUGHTSMEN. Good mechanical men wanted by electrical engineering firm in Lancashire, for control gear, contactor and liquid type. Experience in this particular class of work not essential. Permanency to suitable men. No one already engaged on Government work will be employed.—Apply stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning N. A5649. 2031

DRAUGHTSMEN wanted, preferably used to H.T. and L.T. switchboard work. London district. No person resident more than 10 miles away, or already on Government work, will be engaged.—1878, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Accessories, &c.—Sales Counter Assistant required ; some experience necessary. Applicants must either have received their discharge or be ineligible for military service. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write in first instance, stating experience, wages required, to SUN ELECTRICAL CO., LTD., 118, Charing Cross Road, W.C. 2. 2046

ELECTRICAL Engineer. Designing Engineer wanted by large electrical firm in Lancashire, used to the design of control gear. One with knowledge of contactor gear preferred. No one already on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5653, and stating age, experience and salary required. 2029

ELECTRICAL Fitter wanted with Tramway Motor experience. —Write or call MANAGER, 590, Lea Bridge Road, Leyton, E. 10. 1777

ENGINEER and Manager wanted for small D.C. supply station, seaside. Must have experience of Diesel engines, and be of low category. State full particulars and salary required.—1974, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER for country estate ; oil engines, water turbines, dynamos, pumping and water softening. Man must be ineligible for military service and not employed on Government work.—State experience and wages required to 4966, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER Representative, with good connection with South Wales collieries and works, wanted by electrical manufacturers, (controlled firm). No person on Government work, or living more than 10 miles away, engaged.—State experience, age and salary required. to 5040, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER wanted in factory near London, supplying own electric power for running wood-working and other machinery. Must be competent mechanical engineer with knowledge of electrical plant, and able to act as assistant to engineer in charge.—Apply, stating particulars of age and experience, and wages required, to 5041, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ESTIMATING Clerk wanted by a Controlled Establishment in Midlands, preferably with experience of telephones or small electrical apparatus. The position is permanent, with good prospects for suitable applicant with the right qualifications. No person already on Government work will be engaged.—Apply stating age, experience and wages required, to your nearest EMPLOYMENT EXCHANGE, quoting No. A5645. 2025

SITUATIONS VACANT.—*Continued.*

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

EXPERIENCED Traffic Clerk required to take charge of office. —THE BRITISH AUTOMOBILE TRACTION CO., LIMITED, 113, Caversham Road, Reading. 1895

FOREMAN wanted for the manufacture of moulded rubber parts ; a good opening for a capable man. No person resident more than 10 miles away, or already on Government work, will be engaged.—Write stating age, full experience and wages required, to F. W., c/o Dixon's, 195, Oxford Street, W. 5000

GOOD Plumber-jointer, with E.H.T. experience, wanted at once in large works in South ; permanency for suitable man.—Reply, stating age, experience, and wages required, to 2001, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

HOTEL Engineer required (used to controlling the mechanical electrical plants, &c., of a large establishment), for first-class Lancashire Hotel ; to replace man called for military service. Good wages to a suitable, responsible man.—Write fully to 4995, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

INDIA.—A firm of Engineers and Contractors require the services of a capable Electrical Assistant to take entire charge of electrical branch. Must be ineligible for military service. Good salary to a competent man, who must be prepared to leave for India at once.—Address I. E., care of Dawson's Advertising Agency, 121, Cannon Street, London, E.C. 4. 5032

INSPECTING Electrical Engineer with good commercial experience required to represent large firm of Manufacturers (controlled establishment). Age 25 to 35. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply stating age, experience and salary required, to 2039, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LEAD Burner wanted, used to small portable battery work. Preference given to man having some experience of repair work. Permanency for suitable applicant. No person resident more than 10 miles away, or already on Government work, will be engaged.—5072, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGER (Electrical) for large wholesale firm in Scotland, for duration of War only. Must have a thorough practical and technical knowledge of the trade, and be conversant with all Admiralty and War Office requirements ; first-class commercial experience and exempt from military service ; salary £300 to £350. —Address, with full particulars, 1926, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PAVIOR wanted for tramway track. Regular work.—Apply stating age, experience, present position, references and wages required, to BURTON & ASHBY LIGHT RAILWAY, Swadlincote, near Burton-on-Trent. 5048

PERMANENT Way Foreman (working), required for repair of tramway track. Must be good platelayer and pavior. Permanency.—Apply stating age, experience, present position, references and wages required, BURTON & ASHBY LIGHT RAILWAY, Swadlincote, near Burton-on-Trent. 5047

PLUMBER-Jointer required at once ; permanency for suitable man ; wages 11d. per hour, plus 15s. 6d. per week war bonus, plus 12½ per cent. on earnings ; good housing accommodation.—State age and full experience to the ENGINEER, Electricity Works, Redditch. 1920

PRODUCTION Engineer (Assistant) wanted by London manufacturers of electrical switchgear. No person on Government work, or living more than 10 miles away, engaged.—State experience fully, age, and salary required, to 5039, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PURCHASING Department.—An Assistant, with previous experience of such work, is required by a large engineering company in the Midlands. Applications from discharged soldiers possessing the necessary qualifications, will receive special consideration. No one at present employed on Government work will be engaged.—Apply, stating salary required, and giving full details of experience, to your nearest EMPLOYMENT EXCHANGE, quoting No. A5629. 2009

REPRESENTATIVE for paraffin and other waxes as side line.—Box 27, Horncastle's, 60, Cheapside, E.C. 2. 2012

SHIFT Engineer wanted (certified undertaking). Experience of A.C. and D.C. operation essential. Age over 26 preferred.—Applications, giving full particulars and wages required, to be sent to the ENGINEER, Electricity Works, Dartford, Kent. 4972

SHIFT Engineer wanted for C.C. station ; steam and Diesel engines.—Apply stating experience, with copies of testimonials, stating wages required, to the MANAGER, Wycombe (Boro') Electric Light & Power Co., Ltd., Lily's Walk, High Wycombe. 5051

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

SUPERINTENDENT required for 6000-KW. power station in Scotland. Must have first-class mechanical and boiler-house experience, and, preferably, with 3-phase E.H.T. experience. Good salary to thoroughly reliable man.—Apply, giving salary expected, age, married or single and date on which duties could be commenced, 2056, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant wanted, West-Coast, D.C., three-wire and tramways. Possible advancement to shift engineer. Wages £3 7s. 6d. per week.—Write experience and copy of testimonials, 4928, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendants wanted for Station in North Midlands with 3-wire D.C. lighting, traction and E.H.T. 3-phase, with rotaries running direct and inverted. State age, experience and salary required.—2063, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TECHNICAL Assistant Engineer required, conversant with the manufacture of A.C. and D.C. motor control gear. No person on Government work, or living more than 10 miles away, engaged.—Apply stating age, experience and salary asked, to ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, S.W. 8. 4958

TECHNICAL Assistant wanted with knowledge of Switchgear and experience in commercial correspondence and handling of Specifications. No person already on Government work will be engaged.—Apply by letter to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2028.

WANTED, an experienced Wireman-Jointer for maintenance work on mains, motors and meters.—Apply, stating wages, and copies of testimonials, to CHIEF ENGINEER AND MANAGER, Electricity Works, Leek, Staffs. 2008

WANTED, Armature Winder; must be accustomed to D.C. and A.C. work.—Apply stating age, experience and wages required, to CRIGGLESTONE COLLIERIES, LTD., near Wakefield. 2042

WANTED, Assistant Engineer and Switchboard Attendant, accustomed to D.C. three-wire work. A knowledge of Diesel and gas engines a recommendation. Wages, including bonus to date, 52s. 6d. weekly.—Applications, stating experience, with copies of testimonials, to THE ENGINEER, Electricity Works, Ascot, Berks. 5073

WANTED at once, thoroughly good up-to-date Armature Winder, with knowledge of general winding, for small D.C. machines in quantities. Must be able to act as leading hand, and capable of taking full charge when foreman is away. No person resident more than 10 miles away, or already on Government work, will be engaged.—State age, full experience and wages required, to 2050, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED by leading Engineering Insurance Company, Electrical Surveyors having good knowledge of the theory and practice of alternating and direct-current plant. Only men rejected from the Army or Navy or over military age need apply.—2053, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, competent Man to run country house electrical plant Tangye engine, dynamo, battery and pump, and preferably with some knowledge of Rolls Royce car (driving experience not essential), good wages and cottage (about 30 miles from London). Discharged soldier or ineligible man.—MALCOLM AND ALLAN, LTD., 12, Henrietta Street, Strand, W.C. 2. 2007

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED on a Scottish Power Company (Certified Undertaking), a Shift Engineer with good mechanical and electrical training. Good wages to a man thoroughly experienced in E.H.T. 3-phase work and boiler house control.—Reply giving full particulars, with copies of references, to 1975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Shift Engineer for Power Station, A.C., three-phase, E.H.T. and D.C. supply. Wages £3 10s. per week and overtime.—Apply, giving full particulars of past experience and testimonials, to the MANAGER, Sheerness and District Electric Power and Traction Co., Ltd. 2052

WANTED, Two Colliery Electricians at once.—Apply, stating age and experience, to CRIGGLESTONE COLLIERIES, LTD., near Wakefield. 2043

SITUATIONS VACANT.—*Continued.*

WIREMAN wanted, certified undertaking; permanent to suitable men.—Reply stating rate, age and past experience to MANAGER, Northampton Electric Light & Power Co., Ltd., Northampton. 2049

WIREMEN wanted for urgent Government work. No person resident more than 10 miles away, or already on Government work, will be engaged.—NAPIER-KIMBER, LTD., 3, Wellington Terrace, Bayswater Road, W. 2051

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A MECHANICAL and Electrical Engineer (A.M.I.E.E.), 42 years of age, having had 20 years' exceptional experience on erection of buildings and installation and maintenance of heavy electrical, hydraulic and other power plants, is prepared to consider offers for executive or other position of responsibility where tact, energy, and ability are required. Good organiser and thoroughly accustomed to the control of men. Salary required, £600.—5017, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A QUALIFIED Engineer, desires a position with the following experience; electric light, power and traction stations, mechanical and electrical test house; also concrete testing, &c. Inspecting engineer for shipbuilding and other plant; drawing and office routine.—4921, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrical Instrument Tester, with practical knowledge of calibrating, &c., seeks a situation (in London district preferred).—5064, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN experienced working Foreman requires situation. Conduit installations, also maintenance lighting, heating and power plants. Good references.—4967, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHIEF Draughtsman, shortly disengaged; over 20 years' extensive workshop and electrical instrument experience and jig and tool design.—5037, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COMMERCIAL Electrical, 20 years' general experience. Home and export connection.—5018, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, fully competent all branches, 16 years' electrical surveyor, requires permanent position. Government work preferred. Salary £350, advancing £25 yearly.—4952, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer seeks berth with good firm as inspector supervisor of foreman's job. Wide experience. First-class references.—4951, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (31), thoroughly practical and technical man, possessing initiative and ability, desires responsible post with progressive firm engaged on work of national importance. The advertiser has had first-class experience in several branches of the electrical industry, and is at present in charge of manufacturing departments.—For further particulars apply to 4944, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL FITTER (49), on maintenance, hotel work, open for change.—5050, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER (A.M.I.E.E.), age 36, desires change in responsible position; 17 years' experience, 13 years as chief assistant in large supply undertaking. Excellent references.—5011, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ESTATE Electrician seeks charge of large estate or institution plant.—5045, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PLUMBER-Jointer (Telephone), with thorough knowledge of testing. Would consider power and lighting. Willing to travel. Ineligible.—WILSON, 65, Lea Road, Sparkhill, Birmingham. 4942

RESPONSIBLE post required (scheduled as a protected occupation) as Electrical Engineer or Supervising Electrician. Maintenance or erection of new plant preferred. Engineering and steel works' plant experience; accustomed to armature winding.—4988, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TWO young men (age 17) require situations as wiremen or assistants; experienced. London district preferable.—10, Fearnley Street, Watford. 5046

YOUTH (intelligent) seeks situation; good knowledge of all electrical work. Nearly 17.—MILLER, 69, Netherwood Road, W.14. 5063

(Continued on next page.)

AGENCIES.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.).

Box Number and ELECTRICAL REVIEW address count as seven words.

LOCAL Agents wanted in every town to collect old Electric Lamps on Commission.—Write, 104, Craven Park, London, N.W. 10. 4932

MANCHESTER Firm of Electrical Engineers, wholesale trade with large connection, show-rooms, stores, &c. Open to consider Manufacturers' Agencies for Lancashire and Yorkshire.—4989, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

BOROUGH OF HAMPSTEAD.

Sale of Electrical Plant.

THE COUNCIL of this Borough invite Tenders for the following Steam Plant which they have for disposal :—

Two Willans-Siemens Steam Alternators, 350 KW. each.
One Ferranti Steam Alternator, 350 KW.
One " " " 300 KW.
All single-phase, 90 periods, 2000 volts, for a working steam pressure of 160 lbs.
Also three Feed Water Heaters, with a quantity of H.P. Steam and Exhaust Piping and Valves.

The plant may be inspected by appointment, and Tender Forms and Conditions of Sale obtained upon application to the CHIEF ENGINEER AND MANAGER, Electricity Works, Lithos Road, London, N.W. 3.

Tenders endorsed "Tender for Steam Plant" to be delivered at my office not later than 10 a.m., FRIDAY, JULY 19th next.

By Order,
ARTHUR P. JOHNSON,
Town Clerk.

Town Hall,
Haverstock Hill, N.W. 3.
July, 1918. 2054

MACHINERY FOR SALE.

5-FT. Radial Arm Drilling Machine, by Whitworth ; 2¼" spindle ; slotted bed-plate. Ditto, 4' 6" arm, tapping motion, boxed table.
Treble-geared Facing and Boring Lathe, by Buckton ; 84" face-plate ; strong tool.
Cold Iron Saw, by Isaac Hill ; ditto, by Becker, for two saws.
50-H.P. Stockport Gas Engine ; 20-H.P. Crossley ; 16-H.P. Tangye.
Vertical 3-throw Geared Pumps, 7½" rams, engine driven. Set 6½" ditto, motor driven, 550 volts.
115-KW. Generating Set, 220 volts.
C.I. Tank, 25' × 17' × 4' 6" ; 12,000 gals.
600-H.P. Horizontal Compound Tandem Condensing Steam Engine, rope fly-wheel 18' dia.
Large stock of other machinery.

Further particulars and prices—
J. T. WILLIAMS & SONS,
37, Queen Victoria Street,
London.
Telephone : City 3938. Works : Hop 834. 1998

MACHINERY FOR SALE.

ONE 50-KW. Browett-Siemens Generating Set, 500 volts, D.C.
Two 150-KW. Belliss—Bruce Peebles Generating Sets, 500 volts, D.C.
One 220-KW. Belliss—Silvertown Generating Set, 500 volts, D.C.
One 170-KW. Belliss—Scott & Mountain Generating Set, 250 volts, D.C.
One 150-KW. Browett—Mavor & Coulson Generating Set, 250 volts, D.C.
One 187-KW. Crompton Generator, 500 volts, D.C., for direct coupling to engine, 380 r.p.m.
Also a large Assortment of Motors and Generators.

ROBERT WALKER,
2, Oswald Street, Glasgow. 1941

MOTORS, SWITCHES AND FUSES AND STARTING GEAR.

A.C., 2 and 3-phase, 200 v., 400 v., 50 periods, 5, 7, 10, 15, 25, 27, 30, 35 H.P.
D.C., 220 v., 440 v., 1, 2, 5, 10, 15, 20, 25, 30 H.P.
Power Cables, Distribution Fuseboards and Switches.
Safety Automatic Devices for either A.C. or D.C. circuits.
Concrete, sound materials and workmanship.
Guaranteed 18 months.

"ROBUST MACHINERY," 62, Bradford Street, Walsall. 2040

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

3" by 26" Jones & Lamson, all-geared head Flat Capstan Lathe.
3½" Centres "Lo Swing" Lathe on 8' bed.
2' by 24" Jones & Lamson Flat Capstan Lathe.
Motor-Driven Face Milling Machine, by Hetherington and Co., with facing head 18" diam.
Hori. Boring and Facing Machine, by Noble & Lund, T-slotted table, 2' by 2' 2".
Snout Boring Machine, Worm Driven, T-slotted table, 2' 7" by 2' 6".
Portable Slotting Machine, 4' 6" stroke, with swivelling head arranged for motor drive.
Sellars Patent Hori. Tool Grinding Machine, to take tools up to 2½" by 2½".
No. 3 Four-spindle "Acme" Automatic Screw Machine for ⅝" bars.
Gear-driven Duplex Screwing Machine, by Dron & Lawson, with dies up to 2½" diam., Whitworth thread.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS.
Free on Application. Inspection invited.
THOS. W. WARD, LTD., ALBION WORKS,
Tel. : "Forward, Sheffield." SHEFFIELD.

R. H. LONGBOTHAM & CO., LTD., WAKEFIELD,
and at Milburn House, Newcastle-on-Tyne.
Tel : { 44 Wakefield. / 867 Newcastle. Telegrams : "Engineer, Wakefield."

FOR SALE.

ONE Parsons Steam Turbo Set, 3500 KW., 1200 R.P.M., with alternator field-rotating type and exciter complete ; 6000-volt maximum load, 40 cycles.
One ditto, 1500 KW., 2-phase, 2000 volts, 50 periods.
One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.
One Parsons Turbo - Alternator, 300 KW., two-phase, 2000 volts, 50 periods.
One 225-KW. Generating Set, engine tandem comp. type, 300 H.P., with Corliss Valve Gear, &c., B.T.H. Generator, 500 volts, compound wound. 5277

NEW MOTORS FOR SALE.

21 5-B.H.P. Three-phase, 440-volt, 50-cycle, 575 revs., protected type squirrel cage new B.T.H. Motors, with no-volt release star delta Starters.

Also

One 50-B.H.P. Second-hand Siemens Motor, excellent condition, 500 revs., 500/550 volts, three-phase, 50 cycle, with Liquid Starter.

1981, ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

MACHINERY FOR SALE.

ONE Generating Set Comprising :—
"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m. ; built in 1910, and in first-class order.
Specification and print on request.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

SWITCH BASES.

QUANTITY of White and Black Tumbler Switch Bases for sale. No metal parts. Offers invited.

2017, ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

(*Continued on next page.*)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

GENERATING SETS, D.C.

One 500-KW. Willans-E.C.C., 420/500 volts.
Three 256-KW. Belliss-Siemens, 460/500 volts.
One 220-KW. Willans-A.E.G., 220 volts.
One 200-KW. Allen-Parker, 460/500 volts.
One 180-KW. Anderson-Mavor 220/230-volt Set.
One 160-KW. Belliss-G.E.C., 460/500 volts.

GENERATING SETS, A.C.

Two 500-KW. Belliss-Westinghouse, 2800/3000 volts, 50-period, 3-phase, with spare stator and condensing plant.

TURBO-GENERATORS.

One 500-KW. Parsons, 460/530 volts, with condensing plant complete.

MOTORS, D.C.

One 1,000-H.P. and one 250-H.P., 460/500 volts, with rope drive.

All the above are ready for immediate dispatch.

Apply, FRANK GILMAN.
Lightwoods Hill, Birmingham. 2015

CITY OF ABERDEEN.

THE Electricity Department have for sale three 420-KW., D.C., 440/550-volt, Direct-coupled Sets, Engines by Willans and Robinson, Generators by Westinghouse, Bruce Peebles, and Mavor and Coulson respectively.

Also one Alley & McLellan Surface Condenser of 2100 sq. ft. cooling surface.

One Edwards three-throw Air Pump 9″ diam. by 9″ stroke, maker, Alley & McLellan.

All in excellent condition and can be seen running by appointment.

Offers for above to be addressed to undersigned, on or before noon, TUESDAY, the 23rd JULY.

J. ALEX BELL,
City Electrical Engineer.
Milburn Street, Aberdeen. 2034

ARC LAMPS AND METERS.

FOR immediate disposal, about 200 Continuous Current Davy Arc Lamps with Carbons, 230 volts pressure, and a quantity of house service type and switchboard type Meters.

Particulars on application to BOROUGH ELECTRICAL ENGINEER, Corporation Electricity Works, St. Helens. 2016

WAXES.

PARAFFIN Beeswax, Carnauba, Ceresine, &c. May we quote? Keenest prices only.

NEWMAN & McKAY,
56, City Road, London, E.C. 1.
1996 London Wall. 2019

D.C. MOTORS.

D.C. MOTORS for Sale, 8, 14, 22, 40-B.H.P., 440 volts, slow speed. Certificate required.

2047, ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

CUNNINGHAM, LIMITED.

SMALL Motors and up to 300 H.P. rewound and repaired.

Estimates free. 171, Edgware Road,
'Phone: "5173 Padd." W. 2.

ELECTRIC DYNAMOS AND MOTORS.

MACHINES always available for Sale or hire. ARMATURES and FIELD COILS rewound or repaired without delay.

'Phone: 5773 Holborn. MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1. 8485

FOR SALE.

22 SINGLE-PHASE, 210 volts, 70 periods, Two-rate Meters; sizes to 5 to 100 amps.

Meters and Clocks in good condition. Offers to—

THE ENGINEER,
Electricity Works, Redditch. 1949

ELECTRIC MOTORS.

SALE or Hire. Second-hand Machines in Stock. ARMATURES and Coils repaired at shortest notice.

THE TITAN ELECTRICAL CO.,
9/11, Eagle Street, W.C.
'Phone: Central 13,191. 6493

FOR SALE.—*Continued.*

SPECIAL JOB.

40-H.P., D.C., Motor, 440-V. to 500-V. motor, back geared, with starting panel.

Motor-generator, direct coupled 200-250-V. motor; generator, 100 V., 100 amps.

Concrete jobs. Blue prints supplied or can be inspected. Address below—

"ROBUST MACHINERY,"
62, Bradford Street,
Walsall. 2041

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BABCOCK & Wilcox Boilers (two), each 11,000 lbs. evaporative capacity, 200 lbs. steam pressure. Available immediately.—Full particulars from 5009, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BATTERIES (defective), American make, 3 volts, 2½″ diameter, 6″ height. Large quantity.—ASCOG, LTD., 57, Hope Street, Glasgow. 5044

D.C. MOTORS, 230 V., ¼, ½, ¾, 1, 1½, 2, 3, 5, 7, 12, 20 H.P.; Motors, 460 V., 1, 2, 2½, 3½, 4, 5, 6, 8, 10, 15, 20, 30 H.P.; Motors, 110 V., ¼, ½, 1, 2, 4, 5, 8, 10, 12, 25 H.P.; all cheap.—5057, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

D.C. Recording Voltmeter, by Nalder, in iron case, 0/600 volt. Perfect; just re-calibrated by Maters. Also 100-amp., 440-volt B.O.T. Meter, by Chamberlain, new 1914.—DRUMMOND AND CO., Middlesbrough. 4954

D.C. Starters to 150 H.P. in all types; Shunt Regulators, all sizes; Switches, Fuses, Motor Panels, Voltmeters; Ammeters, 120 cells, 800 amps., 35 cells, 50 amps.—5055, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, 200/250 V., 21, 48, 60, 82, 98, 180, 450, 650 amps.; dynamos, 110 V., 12, 20, 26, 40, 50, 60, 70, 90, 100, 125, 520 amps., in order.—5060, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts; also smaller sizes. Apply for lists.—CANNING & Co., Electro-Platers Engineers, Birmingham. 7769

ELECTRIC Motors and Dynamos, Sale or Hire. Always a large stock of nearly new guaranteed machines. Immediate delivery.—ELECTRO-GENERATOR CO., 1A, Shepherd's Bush Road, W. 'Phone: 488 Hammersmith. 4723

ELECTRIC Motors for sale, A.C. and D.C.; good numbers in stock; immediate delivery.—SUGDEN, Wakering Road, Barking. 4915

FOR Sale, Converter or Charging Set, 200 volts, 135 amps., 115 volts, 20 amps., with Starter, Switchboard and connections.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 2010

FOR Sale, Motor-Generator, by the G.E.C., 500 volts, 225 amps., with two series-wound boosters, 110 volts, 400 amps., 650 R.P.M.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 1996

FOR Sale, nearly new Turbo-Generator, 650 KW., 460 volts, direct current.—Specification and price on application to 2061, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, one 10-H.P., 110-V., 1,000-R.P.M., D.C. Motor.—MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1889

FOR Sale, 70-H.P. Compound-wound D.C. Electric Motor, by the Lancashire Dynamo and Motor Co., 500 V., 500 R.P.M.; 5-H.P., D.C. Electric Motor, by Mawdesleys, Ltd., Shunt-wound, 100 volts, 1650 R.P.M.; 6-H.P., D.C. Electric Motor, by Newtons, No. 17270, Shunt-wound, 100 volts, 1000 R.P.M.; one D.C. Booster, 50 volts, Series-wound, 15 KW., 525 R.P.M., with half-coupling and extended base.—STANLEY ENGINEERING CO., Bath. 1894

FOR Sale, 120-H.P. D.C. Motor by the G.E.C., shunt wound, 500 volts, 650 R.P.M.; now fixed. Immediate delivery.—WILLIAMS & SONS, 37, Queen Victoria Street, London. Telephone, City 3938. 1994

FOR Sale, 500-KW. Parsons Turbo-Alternator, three-phase, 2500 volts. Seen working.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 1995

(Continued on next page.)

FOR SALE.—*Continued.*

HORNSBY Oil Engine, 1½-KW., 25/36-volt dynamo, 300 amp.-hour battery, switchboard, &c., in good order.—4990, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LAMP Caps on sale.—50,000 selected metal filament Lamp Caps suitable for re-manufacture.—HAMPSONS, 141, Higher Cambridge Street, Manchester. 4929

MOTOR, 70 H.P., 440/500 volts, D.C., 200 R.P.M., with starting panel.—MARTINS, 320, Witton Road, Birmingham. 4913

MOTOR-Generator, 400/460 v., D.C., to 60/70 v., 60 a., £70; also Set for 200 v., single-phase, 50/60 cycles, to 60 v., 60 a.—5059, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MOTOR-Generator, 440/60 volts, 80 v., 80 amperes, with stator and shunt regulator.—THE FARAD ELECTRICAL CO., LTD., Farad House, West Hill, Wandsworth. 4961

OIL Storage Tank, 6 ft. 6 in. diameter by 32 ft. length, capacity 6600 gallons.—CARMARTHEN ELECTRIC SUPPLY CO., LTD. 2062

ONE 200-KW. Steam Generating Set for immediate sale, Willans-Mather & Platt, 220 or 440 volts. Perfect working condition.—JENNINGS, West Walls, Newcastle-on-Tyne. 1513

PLATING Dynamos, 50, 100, 200, 2500, 3600 amps.—5061, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TESTING Set, large hot-plate, artistic figures.—EQUIPMENT, 54, Gracechurch Street, London. 5071

TWO 250-KW. Belliss Alternator Sets, each comprising a Compound Enclosed Engine, with E.C.C. Alternator, 3000 volts, 50 periods; quite modern, and for immediate delivery.—HARRY H. GARDAM & Co., LTD., Staines. 1852

4-H.P. Motor-Generator Set, by G.E.C., 440 volts, 2-phase, complete, nearly new.—ORGEL, 304, High Holborn, London, W.C. 1. 5033

5½-B.H.P. National Horizontal Gas Engines, with tank and fitting geared to 100 volts, 20-amp., shunt-wound Dynamo, by Frank Suter, Ltd., with field regulating rheostat; D.P. Accumulators, 7/16 cable, would divide.—JACKSON, Naston Lodge, Palmers Green. 5034

10-H.P., 2-phase, 200-v., 50 ~ Motor, complete, £45; also 6, 20, 30-H.P. ditto; Single-phase Motors, ¼ to 10 H.P., 100/200 v.; 3-phase Motors, 3 to 65 H.P., 220 and 440 v.; six 190-H.P., 3-phase, 50 ~, 550-v. Motors to clear.—5058, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

20-H.P., 220-v., single-phase, 50-period, slip-ring Motor. 5-H.P. and three ½-H.P., 460-v., D.C.; and 18" Wall Fan, 230-v., D.C., and two 50" Ceiling Fans.—BECKWITH, 45, Linton Road, Barking. 5030

25-H.P. Star-delta Oil-immersed Starter, by Ellison, with double automatics, 440/500 volts. Just unpacked.—DRUMMOND AND CO., Middlesbrough. 4953

25-H.P., 3-phase slip-ring Motor, by Siemens, 440 volts, 60 cycles, with short-circuiting device; also complete starting gear.—DRUMMOND & Co., Middlesbrough. 5054

37/14S and 37/16s lead-cased armoured Cable, about 400 yards, for sale cheap.—5010, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

100-H.P. Gas Engine (National) and Suction Gas Plant; can be seen running by appointment. 50-H.P. Motor, 875 R.P.M., 440/60 volts (by Swedish General Electric Co.).—THE FARAD ELECTRICAL CO., LTD., Farad House, West Hill, Wandsworth. 4960

100-KW., 220/240-volt, 6-pole Generator, compound interpole 3-boring type. Perfect order.—DRUMMOND & Co., Middlesbrough. 5053

500-KW. Steam Set, comprising triple-expansion enclosed engine, coupled to Westinghouse multipolar generator, 440/490 volts, D.C. For prompt delivery.—HARRY H. GARDAM AND Co., LTD., Staines. 1413

500-KW. Steam Generating Set, comprising a Belliss triple-expansion engine, coupled to an alternator by the Electric Construction Co., Wolverhampton, 3000 volts, 50 periods, with Wheeler-Worthington independent surface condensing plant; modern plant in first-class condition, and for immediate delivery.—HARRY H. GARDAM & Co., LTD., Staines. 1851

ARTICLES WANTED.

DIRECT AND ALTERNATING CURRENT MOTORS.

ADVERTISER will be glad to hear from anyone having any stock of these for 230 or 440 volts.

They must be new machines and in first-class order, and should be complete with necessary belt pulley, slide rail and suitable starter.

2022, ELECTRICAL REVIEW,
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London, E.C. 4.

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ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. BROWN & SONS, 142, Lower Clapton Road, London, N.E. Telephone: Dalston, 555. Telegrams: Secondhand, Lowclap, London. Established 1860. 4358

AC. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 4765

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 4766

A1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

ALL for Munition purposes.—Obsolete Motors, Dynamos, Insulated Cable, and every description of Electrical Plant bought to break up. Send us your stocks of scrap metals.—G. H. CHAPPELL SONS & Co., Midland Wharves, Lea Bridge Road, Leyton, N.E. 'Phone:—Walthamstow 500. Estab. 40 years. 4707

CIRCULAR Saw and Bench, including Motor, required for sawing firewood and logs.—Send particulars to HALL & Co., LTD., Victoria Wharf, Croydon. 5062

DUDDELL High Frequency Alternator required for use up to 2000 cycles per second. Say where it can be seen, also price.—5038, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or Machinery purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 4505

ELECTRIC Light Plant; oil or petrol engine; wanted for private use.—Send full particulars to A. W., 107, Hatton Garden, London. 2020

HAUSE Dynamo Lighting Set, 4 KW. capacity or near. Engine must be petrol-paraffin. Set with accumulators preferred but not essential.—PORTHOLME, St. John Street, Huntingdon. 2058

MOTOR-Generator. Three-phase, 415/420, 50-cycle Motor, coupled to 100 KW., 100/120-volt D.C. Shunt Generator, preferably complete with starting gear, &c. New or second-hand. If second-hand must be in perfect condition.—1906, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

NICKEL Chrome Wire, 24, 25, 28, 29 g. wanted. Any quantity from 1 lb. up. Cash against delivery or with order.—4991, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OLD Cable urgently required, also Lamp Tops.—WALLACE, Cromwell House, High Holborn. 4114

OLD Electric Lamps with glass intact.—104, Craven Park, London, N.W. 10. 5049

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London.

(Continued on next page.)

ARTICLES WANTED.—*Continued.*

PLATINUM Scrap purchased in large or small quantities. Highest market value given.—Before selling elsewhere call or post to the old and reliable firm, THE DEPÔT, 156, Charing Cross Road, London. Established 1850. 5002

STEEL Tubes, all sorts, wanted; Lampholders and Metal and Cardboard Shades; Gas Lighters, Static Electric; Screws, round head, and Hexagon Nuts.—DUGDILLS, Failsworth, Manchester. 5052

TESTING Instruments. Required, Testing Set, either Ohmmeter and Generator or Megger.—2035, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, battery charging Dynamo, 100/140 volts, 50/60 amperes, with slide rails and shunt regulator.—WARING AND GILLOW, LTD., 164, Oxford Street, W. 1. 5043

WANTED, complete Plant, paraffin engine and dynamo set, with switchboard and accumulators, suitable for 55-volt installation of about 60-20 watt lamps.—State makers, and where and when plant can be seen, to ENGINEER, Electricity Works, Rhyl. 2000

WANTED, for direct-coupling to high-speed steam engine, 500 revolutions, 30/40 KW. Generator, any standard voltage, but preferably 220 D.C.—Reply, stating maker, price and full details, to 1639 ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Generating Sets, all sizes, Boilers, Accumulators, Dynamos, &c., for export: also Scrap Cable and Metals. Complete plants purchased.—WILLIAMS & SONS 37, Queen Victoria Street, London. Telephone: 3938 City. 7000

WANTED immediately, one 50/60-H.P., compound-wound, D.C. Motor, 440 V., with starter; one 30-H.P. A.C. Slip-ring Motor, 440 V., A.C., 50 cycles, 720 R.P.M.; one Cabinet Vacuum Cleaner, 250 V., 50 cycles; also Workman's Time Recorder.—THE NUNEATON ELECTRICAL CONTRACTING CO., Nuneaton. 5066

WANTED, Motors and Dynamos, Ammeters, Voltmeters, Megger Set, Ohmmeter and Generator. Wheatstone Bridge. Portable.—5056, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, old Electric Lamp Caps; any quantity.—5065, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one compound-wound, multi-polar Generator, about 150 to 200 KW., 220 volts, direct coupled to high-speed steam engine, suitable for 120 to 140 lbs. steam pressure. Must be modern type.—W. RICHARDS & SON, Leicester. 5036

WANTED, Second-hand Gas Engine of from 60/100-B.H.P. Complete with cooling tanks.—BOX 60, 29, Queen Square, Bristol. 5031

WANTED, second-hand Motors, in good condition, 1 H.P. and 1/6th H.P., 220 volts, direct current.—State full particulars and lowest prices.—2057, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED (to purchase or hire) new or second-hand Plating Dynamo, 400 amps. or over (up to 2,000 amps.); must be in good condition.—RILEY MOTOR MANUFACTURING CO., Coventry. 4992

WANTED, Tucker or Wandsworth Switches, flush type, one-way and two-way; oxy. silver finish preferred.—State quantity and price to J. E. DYSON, Shambles Lane, Huddersfield. 5029

WANTED, two A.C. Motors, 110 volts, 60 periodicity, 20/30 H.P., single phase.—Particulars to CRYSELCO LIMITED, Kempston Works, Bedford. 1826

WANTED, two 50-H.P. and one 12/16-H.P., 440-volt, 3-phase, 25-cycle, 500/750 revs. Motor, slip-ring type with short-circuiting gear and liquid starter; also one 6/8-H.P. Squirrel-cage Motor, with starter, 700/1000 revs.—1967, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, vertical compound high-speed Engine, 80/100 H.P., enclosed, self-lubricating type, by well-known maker preferred. Send price and full details, to 1638, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, ¼-H.P. Single-phase Motor, periodicity about 60, 110 volts.—E. POWELL, LTD., Tunbridge Wells. 5035

WANTED, 5 to 7-H.P. 550-volt Shunt or Compound-wound Motor, together with starting switch and resistance.—Particulars to THE MANX ELECTRIC RAILWAY CO., LTD., Douglas, I.O.M. 2055

WANTED, 100/250-KW. Vertical Gas Engine, with 220 volts. Generator preferred.—1997, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 500 to 1,000-KW. Turbo or Reciprocating Set, 2,200 volts, 25 periods, complete with condensing plant.—1950, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARTICLES WANTED.—*Continued.*

25-H.P., 500-volt Motor, D.C., wanted, about 800 revs.; complete or nearest.—5067, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

25-H.P., 3-phase, 550-volt Motors, 25 cycles, slip-ring for mines, wanted.—5068, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

230-VOLT, D.C., 5-H.P. Motor wanted; also 400-volt, D.C., 3-H.P. and 4-H.P., 480-volt, the latter totally enclosed.—5069, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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TO Let, four good rooms (self-contained) on fourth floor of building on Ludgate Hill; electric light, lavatory, &c.—Apply to PUBLISHER, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4. 4522

MISCELLANEOUS.

WOODWORK.

IF you are in trouble for early delivery of this class of work, we may be of assistance to you. Early delivery assured. London works.
Address: S Box 92, Willings, 125, Strand, W.C. 2. 2011

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SWITCHBOARD, Starter Panels, and like electrical work carried out to specification by Firm now completing contracts; own foundry and up-to-date machine shop.—4994, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, repairs lighting, motors, telephones, bells.—"ELECTRICIAN," 15, Westfield Road, Croydon. 5070

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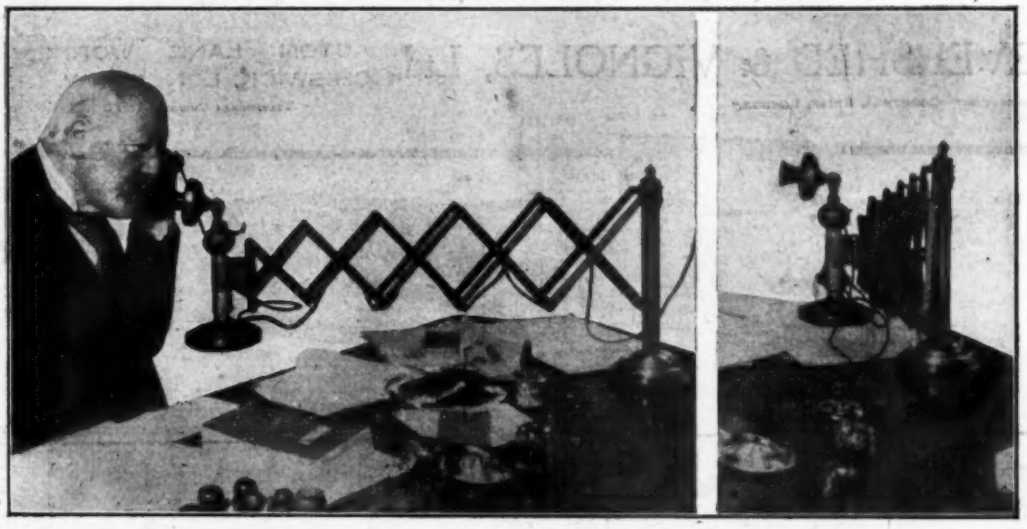

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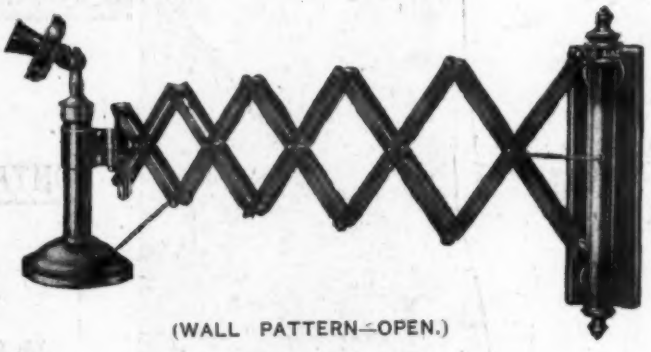

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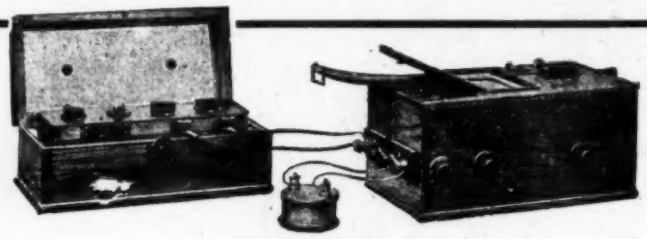

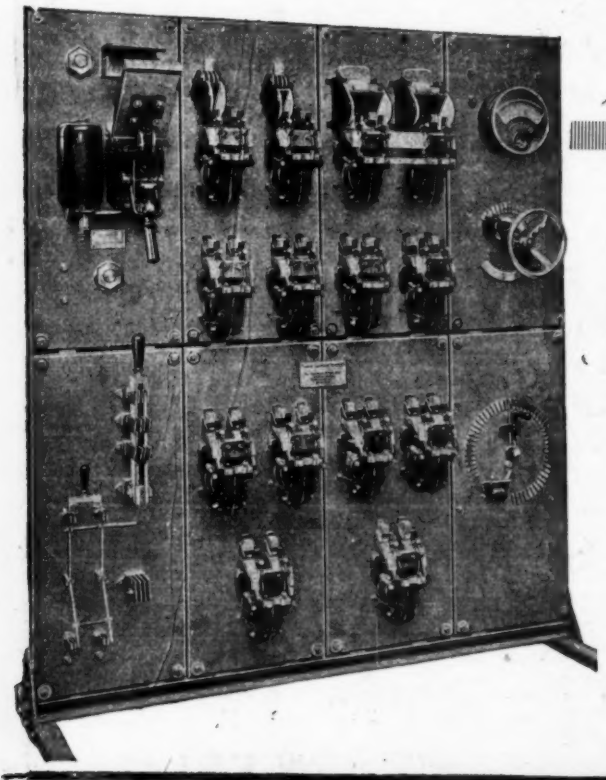

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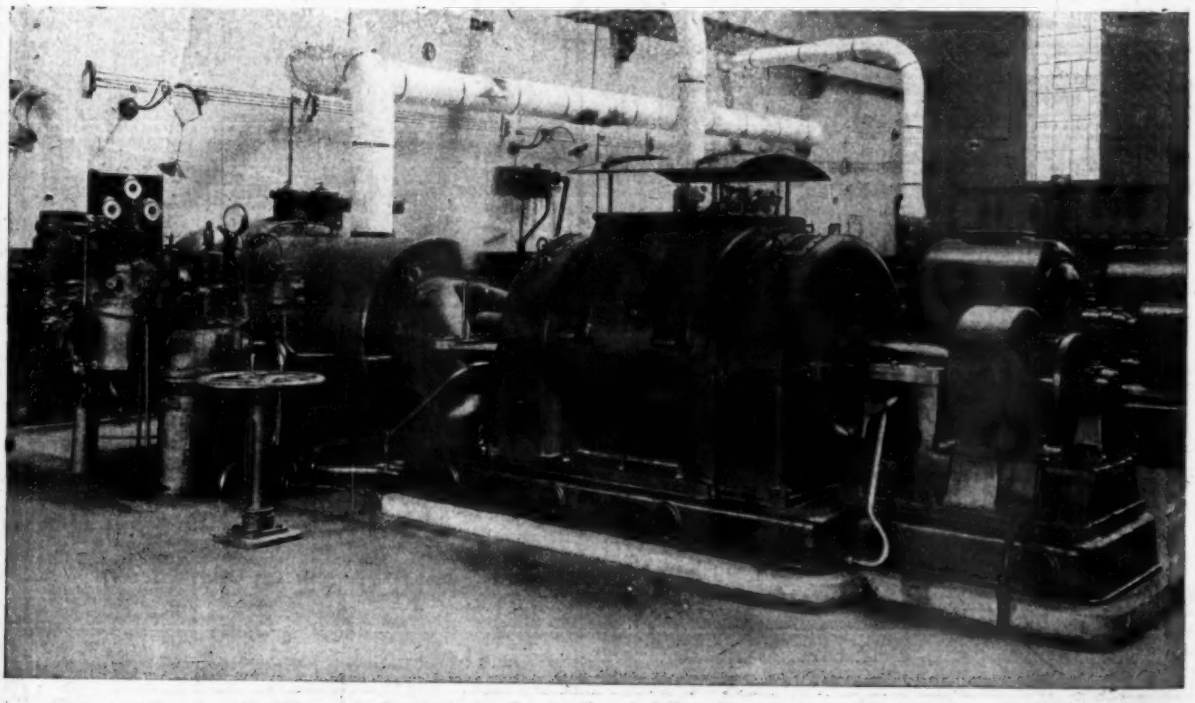

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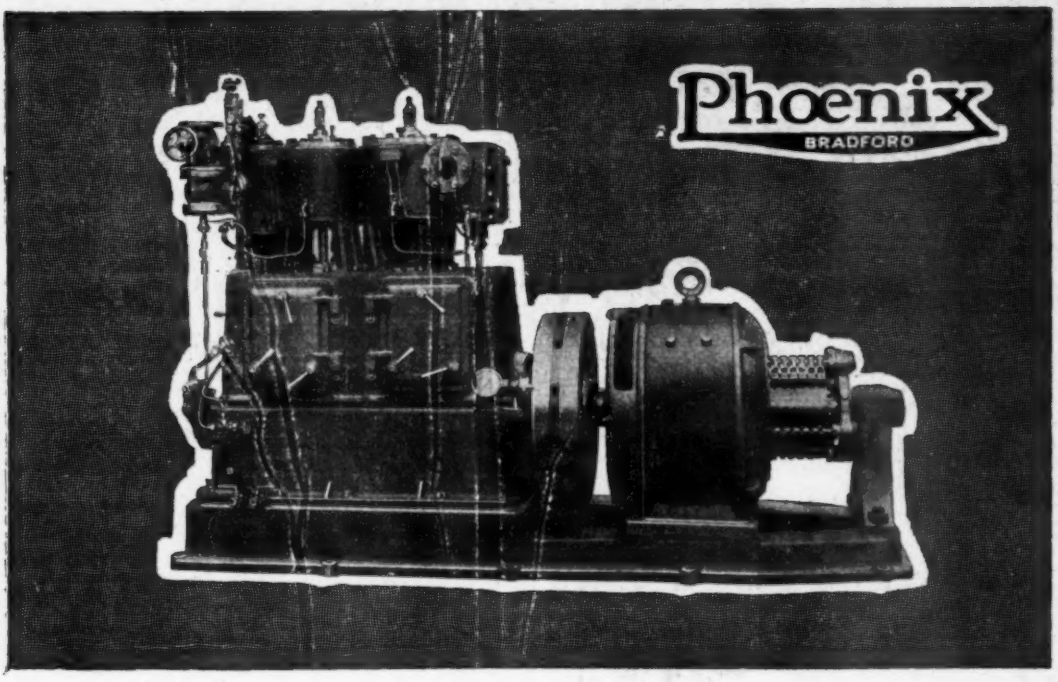

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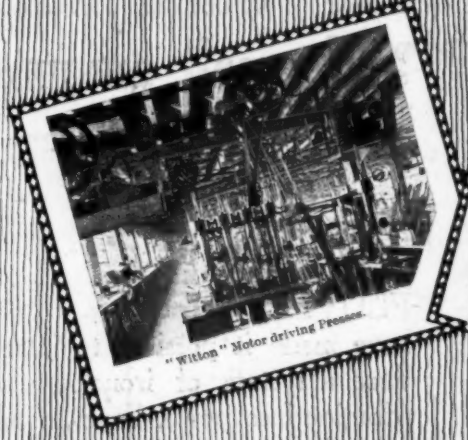

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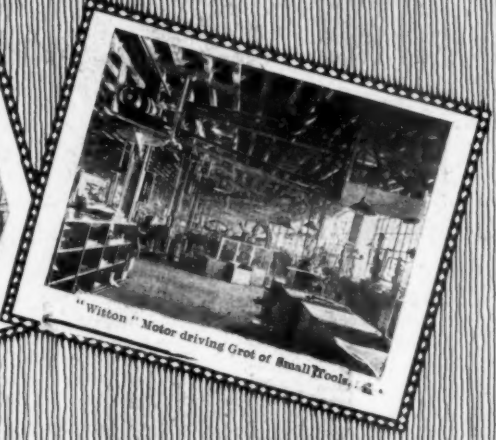

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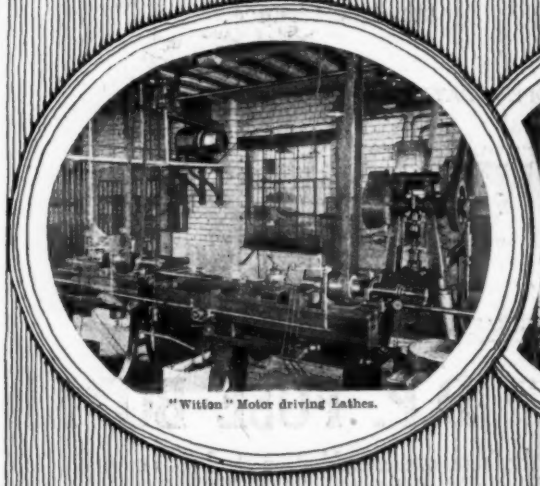

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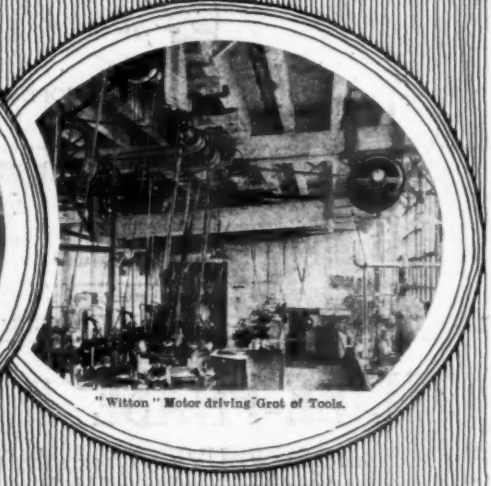

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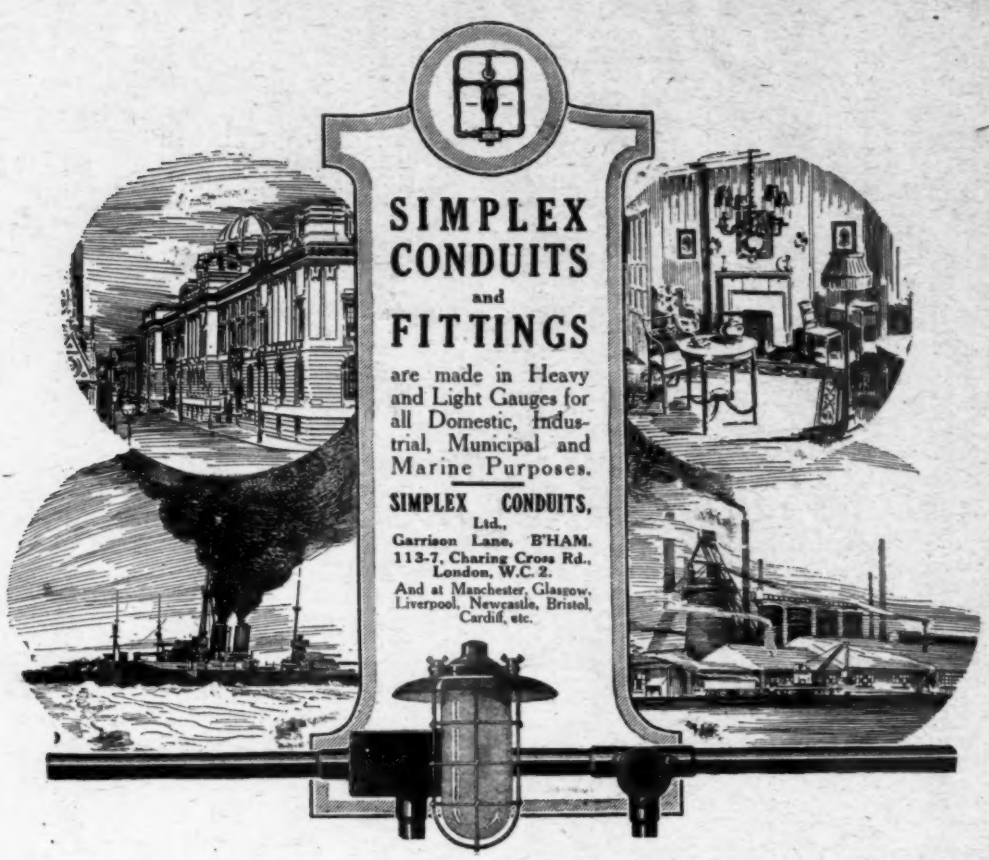

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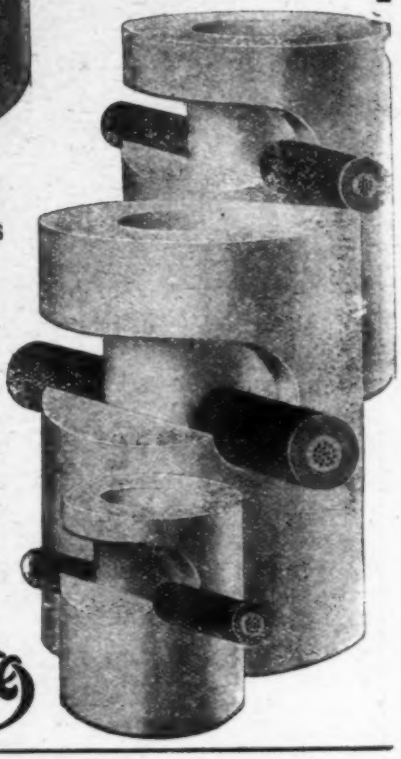

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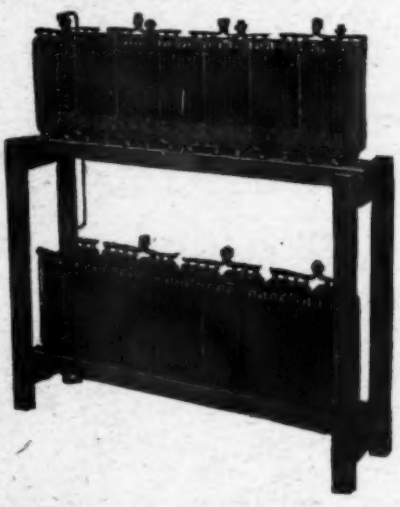

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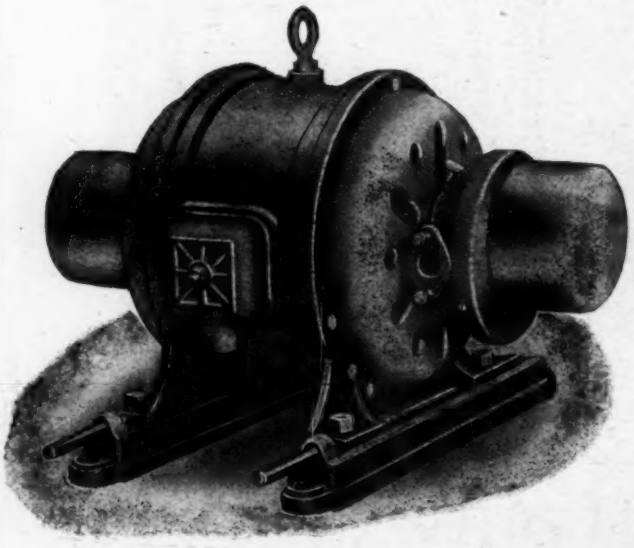

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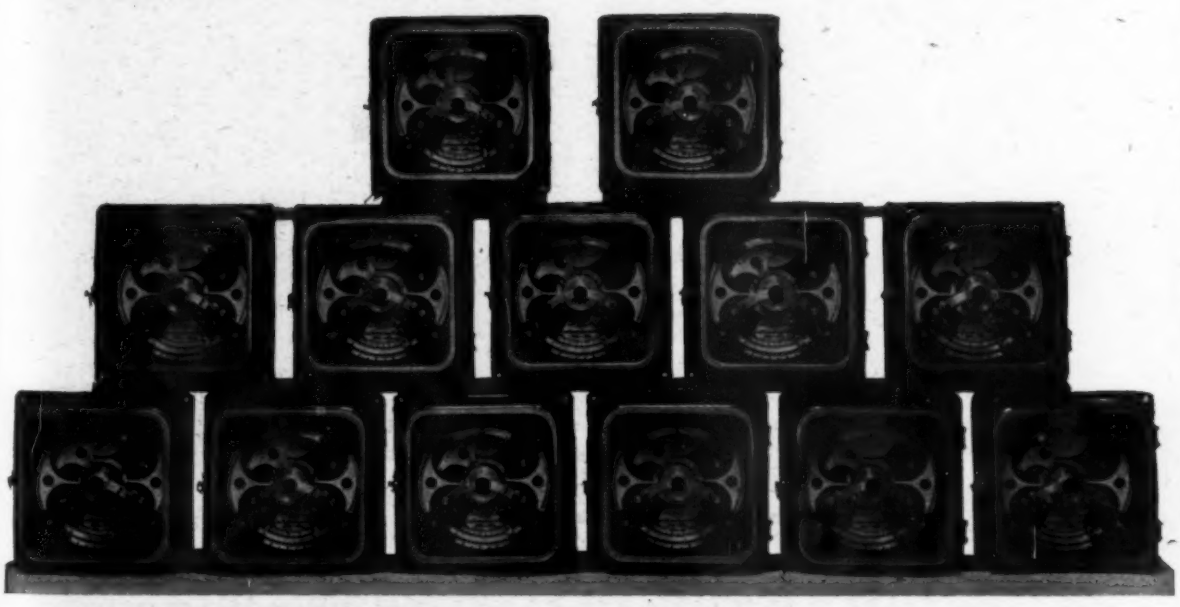

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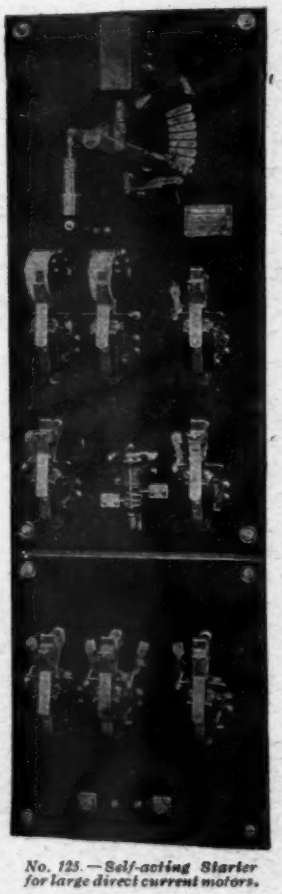

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Operating a Turbine with Stripped Blading.—Mr. H. S. Reeder, writing to *Power*, relates an experience due to losing six rows of the low-stage blading on a 500-KW. unit. The accident occurred with about 40 per cent. load on the turbine just after the generator had been synchronised with another unit, and at the time the attendant was building up the vacuum on the condenser. The stripping of the blading was caused by water being forced up into the low-pressure end of the turbine by the priming pump after the circulating pump had stopped owing to a blown fuse on the motor drive, a jet condenser being used. After removing the stripped and distorted blading from the cylinder and spindle, the turbine was put back in service and operated for several months before renewing the low-stage blading, it being capable of pulling the full rated capacity of the generator, although at a considerable increase in steam consumption.

Wages in Electricity Undertakings.—A mass meeting of the Electrical Trades Union, the National Union of Enginemen and Mechanics, the General Workers' Union, and the Workers' Union will be held at Holborn Hall on Tuesday, July 16th, at 7.30 p.m., to consider the report of the Conference on Wages in Generating Stations, Sub-stations, and Mains Departments in the London district.

Rules for Lightning Conductors.—The latest Swiss rules concerning lightning conductors deal in detail with the materials to be used, the principles and methods to be followed during erection, and the policy to be adopted as regards inspection and testing.

Spiral and other "fancy" finials reduce the efficiency of a lightning conductor. Large metal parts outside the building, *e.g.*, ridge plates, metallic roofing, gutters, and rain-water pipes, should be connected to the conductor system, and used as far as possible, instead of special conductor wires. The large surface of such parts makes them more effective in dealing with lightning discharges than the heaviest practicable wires. Large masses of metal inside buildings should be connected to the conductor system at their highest and lowest points. All the higher points of a building should be provided with conductors, since the area protected by one conductor is much smaller than commonly supposed. Chimneys should always be safeguarded, a high chimney being fitted with a metal crown ring, from which conductors run to earth on opposite sides of the shaft.

Solid wires, stranded ropes, or rolled strips of copper or galvanised iron may be used as conductors. Copper conductors and earth wires may be zinc- or lead-sheathed, if desirable. A lead earth wire may be used where there is special risk of corrosion, but it should be not less than 75 sq. mm. in section, and mechanical protection should be provided by a pipe or other means. The dimensions of conductors should be not less than the following values :—

	Copper.	*Galvanised iron.*
Solid wires, minimum diam. ...	6 mm.	8mm.
Stranded rope, minimum section	34 sq. mm.	65 sq. mm.
Stranded rope, minimum diam. of wires.	2·5 mm.	3 mm.
Strip, minimum section... ...	40 sq. mm.	75 sq. mm.
Strip, minimum thickness ...	2 mm.	3 mm.

Accessibility for inspection and repair is an important consideration. Connections should be effective and durable; bends should be avoided; mechanical protection should be afforded where desirable. The connection between conductor and earth wire should be easily accessible to authorised persons only.

Two conductors should be provided on buildings covering areas up to 300 sq. m., with an extra conductor for each additional 200 sq. m. A water-pipe system forms an excellent earth connection. Various suggestions are made for other earth electrodes; these include the use of 10 or 15 m. of strip or wire laid zig-zag or of metal rope splayed out, the minimum cross-sections for iron and copper being as above. Plates 50 × 100 cm. in area and 1 mm. (copper) or 2 mm. (iron) in thickness may be used. Not less than 1 sq. m. of netting may be used with meshes not less than 500 sq. cm. in area, and conductors of the same minimum section as above. Lead wire or strip 75 sq. mm. in section, or lead plates 3 mm. in thickness, may be used where there is much risk of corrosion. A ring earth wire round the building at a depth of 40 or 50 cm., and with radiating branches, is useful where earthing conditions are unfavourable. If the soil is not permanently moist, the earth electrodes should be placed in a layer of moist clay or charcoal, but not in coke or ashes. Service tests, particularly of earth resistance, should be made at intervals not exceeding five years, and much oftener in the case of important buildings.—*Schweizer Elektrotechnischer Verein, Bulletin.*

Fatalities.—On Thursday, last week, after two hearings, a Coroner's jury returned a verdict of "Accidental death due to electrocution" in the case of W. H. Kershaw (42), a station attendant in the employment of Thwaites Bros., Ltd., engineers, Bradford. Evidence was given that Kershaw was working in the transformer sub-station at the engineering works. He knew all the appliances, and the warnings in the room had been drawn up by him. On Sunday he and a labourer were repairing a high-tension cubicle adjoining the station, and the work appeared to have been completed early in the afternoon. In the evening the two men overhauled the mechanism to see that all was in order. Kershaw went to test the high-tension cubicle on which he had been working, first switching on at the main. On then switching off, the indicator on the cubicle showed that the current was partially on. To investigate further, Kershaw went to open the cubicle door, but it would not move. He went to the back and unscrewed a steel plate to gain an entrance. The labourer looked inside, and remarked to Kershaw that the indicating lamp was not showing. Kershaw then entered to try to find the fault, and immediately after there was a flash, and every electric lamp went out. The cubicle was a mass of flame. Kershaw was quite dead when, with assistance, he was extricated. The body was badly burned. Mr. Andrew Ryan, electrical engineer at the works, said it was not Kershaw's duty to remove the back plate, and he should not have done so. It was stated in evidence that Kershaw received a shock at from 3,000 to 6,000 volts, and that it was "practically suicide" for him to be doing what he did.

Idwal Davies (8), of Mardy, was recently killed by an electric shock. He was playing ball near the Lockett-Merthyr Collieries, when the ball alighted on the roof of the electric power station. Davies climbed up to fetch it, but caught hold of a live wire. His right hand and arm were burnt almost away.

Non-Ferrous Metals Act.—The *London Gazette* for July 9th contains a further list of companies, firms, and individuals to whom licences have been granted under this Act.

Plant for Disposal.—Hampstead B.C. invites tenders for the following steam plant:—Two 350-KW. Willans steam alternators, one 350-KW. and one 300-KW. Ferranti steam alternator, three feed-water heaters, &c. For particulars see our advertising pages to-day.

Institution Notes.—Association of Mining Electrical Engineers.—The annual meeting of the North of England branch of the Association was held in Newcastle-on-Tyne. The report of the hon. secretary and treasurer (Mr. T. H. Day), which showed an increase of members and an enhanced cash balance in hand, was adopted. The officers for the ensuing year were elected as follows:—President, Mr. C. A. Nelson, Wallsend and Hebburn Collieries; vice-presidents, Messrs. J. P. Foster (Leeholme), and S. A. Simon (Blackhill); secretary and treasurer, Mr. Thos. H. Day (Benton).

Mr. F. Church, of Tibshelf, has been elected president, and Mr. A. R. Davies, of Bolsover, and Mr. W. Wynes, of Mansfield, vice-presidents of the Midland Branch of the Association.

The I.E.E. Benevolent Fund.—Mr. W. Lang and Sir W. Slingo have been appointed by the Council to be members of the Committee of Management of the Benevolent Fund, in succession to Dr. Alex. Russell and Sir John Snell.

Appointments Vacant.—Assistant engineer and fitter, for the Royal Burgh of Sterling Electricity Works; switchboard attendant, 25s. + 20s. + 12½ per cent., for the Ipswich Corporation Electricity Department; two junior shift engineers (63s)., for the Burnley Corporation Electricity Department; switchboard attendant, 35s. + 15s. 6d. + 12½ per cent., for the Redditch U.D.C. Electricity Works; switchboard attendant, 25s. for the Loughborough Corporation Electricity Works. See our advertisement pages to-day.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 27 by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. Darley Bentley.
Monday, July 15th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30.
Tuesday, July 16th, to Thursday, July 18th.—Drills as usual.
Friday, July 19th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30.
Sunday, July 21st.—Commandant's Parade at Waterloo Station, 8.45 a.m. for work at Esher. Dress: Drill order, with haversacks and waterbottles. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Electric Lamps in Collieries.—During an inspection which was made last week by members of the Midland branch of the Colliery Managers' Association of the Kirkby and Lowmoor pits of the Batterley Co., some interesting information was forthcoming as to the success which had attended the introduction of electric lamps into the workings, the first installation of which was made two years ago. Mr. H. E. Mitton, the manager, forwarded a communication stating that the result had been a large decrease in the number of nystagmus cases. Success depended upon having a very competent man in charge to see that the lamps burned full time, so as to prevent overcharging when they were returned. The electric power plant in the pits includes a 1,250-KW. Curtis mixed-pressure turbo-alternator, the total capacity of the plant at 75 per cent. power factor being 2,240 KW., and the present average output per day 11,500 B.O.T. units.

Static Frequency Doublers.—The static frequency doubler is based upon the superposition of a steady field upon an alternating field. In the form discussed two magnetic circuits are juxtaposed, so that a coil carrying direct current is interlinked with both magnetic circuits. Each of the magnetic circuits contains two coils that are connected in pairs consisting of one coil from each circuit. One of these pairs is connected in series with respect to the alternating current fluxes, and is connected to the supply circuit. The other pair is connected in opposition, and supplies alternating currents of twice the supply frequency. For a given sum of the alternating and direct-current ampere-turns the secondary flux has its greatest value if the ratio of the maximum value of the A.C. ampere-turns to the D.C. ampere-turns is equal to 2. The sum of the alternating and direct-current ampere-turns should be chosen, so as to give a minimum magnetising current.—M. OSNOS, in the *E.T.Z.*

REVIEWS.

Liquid Fuel for Internal-combustion Engines. By HAROLD MOORE, M.Sc.Tech., F.C.S. London: Crosby Lockwood and Son. Pp. xv + 200; figs. 49. Price 12s. 6d. net.

Anything which will spray and is combustible has been defined as a fuel for liquid-fuel furnaces. Provided that it contains no solids bigger than a reasonably fine mesh of brass gauze, the definition is not far out of reality. But with the internal-combustion engine it is different, for a fuel may burn readily, and be easily capable of being sprayed into a Diesel cylinder, yet it may be so loaded with fine particles of free carbon that it cannot be used, for the carbon will deposit and spoil the working of the engine.

The internal-combustion engine is, in short, by no means the simple thing in respect of fuels that a casual thinker might imagine. In this book, which appears to say almost the last word that can be said of so multifarious a subject, the engineer who has to deal with this class of engine will surely find all he is likely to want so far as the choice of fuel is concerned. Involved chemical research into liquid fuels is not attempted. The author takes the liquids as he finds them, and deals with them on their physical and mechanical sides, and, so far as necessary, with the more simple chemical facts, and with the thermal or thermo properties.

The type of engine has, of course, much to do with the choice of a suitable liquid fuel, and the author takes three classifications, viz.: (1) Engines fitted with carburettors, such as the petrol engine; (2) engines fitted with simple vaporisers, such as the paraffin motor; (3) engines fitted with fuel pumps and atomisers, such as the Diesel and the semi-Diesel type. He might, perhaps, have added a fourth class, or the engine with the selective vaporiser of the Griffin type, wherein an asphaltic oil is vaporised as regards its best constituents, and the asphaltic portion is run liquid out of the vaporiser instead of being allowed to go hard and cold in a standing engine, gluing the parts fast. This class is certainly only a variant of class 3, but merits special mention because of the difficulties which it overcomes. Indeed, it should overcome the free carbon difficulty, and so render some of the impossible tars capable of use in the vaporiser engine.

The author remarks that coal cannot be burned in the internal-combustion engine. Yet Diesel, in his book on the rational heat motor, by which he meant the first form of Diesel engine, did actually describe it as a powdered-coal engine, though it is not easy to understand how he expected to avoid dust and grit troubles.

In dealing with liquids of a combustible nature, petroleum is clearly entitled to the first mention. The world's output in 1915 was nearly 427 million barrels, or, say, 60 to 70 million tons—a small fraction of the world's coal production to be kept in mind in all dealings with the subject, for this small fraction of about 5 per cent. tells us that however used, liquid fuel can only serve the special, and not the general, purposes.

Wisely, very little space is devoted to the origin of petroleum—why stir up sleeping dogs? A few pages are allotted to the definitive chemistry of the olefines and paraffins, and of the chain and the ring formation of the carbon atoms. Shale oil receives two pages, and coal tars follow with 10. Wood, peat, and lignite are briefly treated, the animal and vegetable oils, valuable as they are, being more fitted usually for other industrial or edible uses.

The alcohols close the list with an interesting three pages, for the author has the gift of putting useful matter into small bulk, and does not waste words. Thus at page 38 appears a chapter on fuels for carburettor engines, at present certainly the most important class because of their use in aircraft work. This chapter is full of interest, and the remarks on explosive range should be familiar to all users of such engines.

Specific gravity, spontaneous ignition in its relation to compression, calorific value, and boiling point are all given, and one sees why alcohol, with its lower calorific capacity, will give a higher thermal efficiency than more easily ignited petrol.

The next chapter deals with the fuels for vaporiser engines, or those in which the fuel enters the cylinder before compression, and Chapter X deals with atomiser engines, or the Diesel and semi-Diesel classes.

Though all classes of oils may be used, there are some which contain so much extraneous matter as to unfit them for use; and it is very difficult to filter out free carbon.

Asphaltum trouble is referred to, but the author dismisses asphaltic oils as impracticable for Diesels, and says nothing about their use in engines with selective vaporisers. Part II closes with a number of analyses and much other valuable information.

Part III deals with the examination of fuels physically and chemically. Perhaps its most valuable portion is that dealing with mixed fuels and the temperature of spontaneous ignition with combined temperature and pressure, as in the Diesel and similar types of engines. This is, of course, the crucial factor in such engines, and fixes the lower limit of compression. In Chapters XI and XII valuable physical constants may be found, the latter chapter dealing with the subject of calorimetry.

An appendix closes the volume, and in it are given many tabulated fuel statistics additional to those found through the body of the book. One table in particular is new, giving the weight of air and of oxygen, and the volume of air and oxygen necessary to burn weights or volumes of five fuels from 1 to 9 units, the fuels ranging from CH_4 and CO, H and C, to C_2H_4. Carbon, of course, is excluded from the volume list. The Admiralty fuel-oil specification is given, also that of the German Tar Distillers' Federation and others. A glossary of trade names for petroleum products precedes an excellent index.

Practical Electricity. By TERRELL CROFT. London: Hill Publishing Co. Pp. 646; figs. 582. Price 10s. 6d. net.

In the sense in which we understand the term in this country, the title of this book is misleading. It does not, for instance, deal with the subject which is dealt with in Ayrton and Mather's book of the same name; in other words, it does not deal primarily with the laboratory aspect of electricity. Rather must it be classed as a text-book of applied electricity. The scope and method of the book, however, render it extremely difficult to compare with any contemporary English texts, and in order to define its exact *raison d'être* we cannot do better than quote from the author's preface:—

"'Practical Electricity' was written for certain definite purposes. Primarily, its object is to present the fundamental facts and theories relating to electricity and its present-day applications in a straightforward, easily understood way for study by any man, of little mathematical training, who desires to acquire a working knowledge of the subject. If a man understands arithmetic, he should be able to get the meat out of this book. Secondarily, the book was designed for university graduates who desire a medium whereby they can, with minimum effort, review, refresh, and reconstruct in line with modern theory and practice their concepts of electric and magnetic phenomena."

Owing to the rapid and "intense" courses which are now being provided in many industries for the instruction of war workers, methods of teaching based on analogies and illustrations are becoming more and more popular, and the book under review is a remarkable example of the efficacy of such methods in the teaching of electricity. That this subject is susceptible of "analogical" treatment has been proved by the mechanical contrivances devised by Drysdale, and improved upon by Perren Maycock and others, but we do not remember having seen more complete and satisfactory use made of the hydraulic analogy than in this book. Potential, current, resistance, inductance, capacity are all accurately paralleled in hydraulic circuits, and two- and three-phase distribution and the three-wire system are also illustrated in the same way.

The book commences by devoting an unusual amount of space to the theories of electricity, and the fundamental notions concerning matter, electrons, and the ether are developed in considerable detail. Magnetism is then dealt with, and special chapters on this subject are given to industrial uses of magnetism, such as lifting magnets, and to the magnetic properties of iron and various kinds of steel.

The section entitled "Fundamental ideas concerning electricity" is a suitable introduction to the succeeding sections on current, electromotive force, work and power, and to the study of electromagnetism up to and including hysteresis. Two important sections are then taken up by the study of primary and storage batteries, with a short section on electrolysis. Following are chapters on the different forms of electromagnetic induction and inductance. Having thus prepared the ground with exceptional thoroughness, the author commences to deal with electric generators, first treating of the principles, and proceeding step by step to build up the theory and practice of armature and field constructions, armature reaction, and commutation in both bipolar and multipolar machines. The D.C. motor is then dealt with in a similar manner, and here, as elsewhere, the author spares no pains to elucidate his subject by means of analogies and illustrations.

Finally come the sections relating to A.C. generation, equipment, and characteristics, both single-phase and polyphase. The chapter in this part dealing with transformers is worthy of special praise, both on account of its method of treatment and the well-prepared diagrams used to illustrate it.

Throughout the text numerical examples have been used to illustrate the use of formulæ, &c., but higher mathematics have not been used in any part of the book. Whatever of theory the book contains is described by the author as "practical theory," and its inclusion is amply justified on the ground that the effective application of practical information depends upon the understanding of certain vital principles which must, with or without the knowledge of the practician, underlie such information. Perhaps it is worth while suggesting to the author that the inclusion of higher mathematics could have been defended on equally logical grounds.

The book is well produced and admirably illustrated; nor are its merits merely superficial, for in method of treatment, clearness, and accuracy it leaves little to be desired. Mr. Croft will no doubt find that the seven years spent in the making of his book will have an appropriate reward.—P. H. S. K.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Hackney Electricity Committee has reported as follows respecting Mr. Robinson's request recently mentioned here:—

> The borough electrical engineer has placed before us further information as to the nature of the work and the scope of the department in which his services would be utilised if the requisite permission is granted, and after thoroughly going into the matter it does not appear to us that the proposed work to be undertaken can be considered to be of greater national importance than what is now being carried out by the officer in connection with the Council's electricity undertaking, and the maintenance of a supply of electrical energy to the many important premises in the borough which are primarily engaged upon work essentially necessary for the successful prosecution of the war, and where a temporary failure of supply would be of serious moment. As we have come to the conclusion that the national service will not be benefited by an exchange of duties, we do not think it expedient that the permission asked for in the borough electrical engineer's communication should be granted, and therefore recommend that, for the reasons above stated, the Council are unable to grant the borough electrical engineer permission to accept a commission in His Majesty's Forces.

Mr. Robinson's services are asked for by Sir John Hunter, Administrator of Works and Buildings, Air Ministry.

At the Newcastle-on-Tyne City Council on July 3rd, Mr. R. Mayne (chairman of the Tramways Committee) moved a recommendation that the salary of the tramway engineer and general manager, Mr. ERNEST HATTON, be increased from £1,000 to £1,500 per annum, at the rate of £100 per annum for five years. The report was adopted with one dissentient. In connection with the proposal, the committee had issued a statement of salaries paid to similar officials in other towns. This included the following:—

> Bexley, 5 miles measured as single track, engineer and manager, £700.
> Birmingham, 123 miles, engineer £1,600, manager £1,500.
> Bradford, 108 miles, engineer £900, manager £1,000.
> Cardiff, 18 miles, engineer and manager, £1,000, and pupils.
> Darlington, 9 miles, engineer and manager, £700, rising to £800.
> Glasgow, 198 miles, engineer £1,250, manager £1,500.
> Leicester, 21 miles, engineer £900, manager £600.
> Liverpool, 124 miles, engineer £1,600, manager £1,500 (deputy £800).
> Manchester, 184 miles, engineer £1,500, manager £1,500 (deputy £750).
> Newcastle, 72 miles, engineer and manager, £1,000.
> Reading, 13 miles, engineer and manager, £800.
> Salford, 75 miles, engineer £1,250, manager £750.
> Sheffield, 79 miles, engineer £1,200, manager £1,200.
> Sunderland, engineer £1,000, manager £600.

The salary of Mr. A. W. CLEGG, electrical engineer to the Accrington Corporation, has been increased from £400 to £500 a year.

Chesterfield Corporation Electricity Committee has recommended that Mr. W. A. TOPPING, assistant electrical engineer, be paid a war bonus of 10 per cent. on his salary of £230.

Mr. E. J. H. BLUETT, electrical engineer to the Ascot District Gas & Electricity Co. since the opening of the electrical department in 1907, has tendered his resignation upon being granted a temporary commission in the R.A.F.

General.—The Albert Medal of the Royal Society of Arts for 1918 has been awarded to Sir RICHARD TETLEY GLAZEBROOK, C.B., Sc.D., F.R.S., "for his services in the application of science to the industries of peace and war, by his work as Director of the National Physical Laboratory since 1899, and as Chairman of the Advisory Committee for Aeronautics."

Mr. HOPKIN MORGAN, electrical engineer to the Port Talbot Railway & Docks Co., has been appointed by the Coal Mines Department of the Board of Trade to be district engineer.

According to the *Times*, Dr. HORACE LAMB, Professor of Mathematics in the University of Manchester, and Sir E. RUTHERFORD, F.R.S., Langworthy Professor and Director of Physical Laboratories in the University of Manchester, have been elected foreign members of the Royal Academy "dei Lincei," Rome.

Mr. OLIVER HEAVISIDE has been elected an honorary Fellow of the American Institute of Electrical Engineers.

According to the *Review of the River Plate*, Mr. F. H. JONES has resigned from the position of engineer and manager of the power plants of the Compania Alemana Transatlantica de Electricidad.

The Franklin Institute has presented the Franklin Medal to Signor GUGLIELMO MARCONI in recognition of "his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams, without the use of metallic conductors."

Roll of Honour.—Sergeant HUGH MAGEEHAN, R.E., who has been awarded the Military Medal for good work in laying lines and keeping up communication during the German offensive, was employed in the Manchester Corporation tramways department.

Sapper R. JACKSON, R.E., who is in hospital suffering from trench fever, was an electrical engineer in New York before the war.

The Military Medal, for devotion to duty, has been awarded to Gunner F. YATES, R.F.A., who was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Pioneer A. GREGORY, R.E., reported missing, was employed by the St. Helens Cable & Rubber Works.

Private F. QUINN, Labour Battalion, accidentally killed, was employed as an electrician in Oldham before the war.

Private W. H. JONES, Lancashire Fusiliers, who has died of wounds, after being previously reported missing, was employed by the Bury Corporation as an armature attendant at the tramway depôt.

The Meritorious Service Medal for services rendered with the Forces in France has been awarded to Sergeant W. C. COLLIER, R.E., formerly on the staff at the Whitby U.D.C. electricity works.

Lieutenant THOMAS HAMILTON, fourth son of Mr. J. B. Hamilton, the general manager of the Leeds Corporation tramways, has been made a Member of the Order of the British Empire in recognition of an act of gallantry performed during instruction in bomb-throwing in February, 1917. Lieutenant Hamilton was posted missing on May 12th, 1917, and has not since been heard of, death now being presumed.

Obituary.—MR. W. T. PRESSLAND.—The death is announced of Mr. W. T. Pressland, of Ryde, consulting engineer to the Isle of Wight Electric Light & Power Co., Ltd., and one of the first directors of the concern. He was 57 years of age.

MR. G. W. WILLCOCKS, C.B.—We regret to record the death, which occurred somewhat suddenly on July 7th, at the age of 70 years, of Mr. George Waller Willcocks, C.B., M.Inst.C.E., formerly Chief Engineering Inspector to the Local Government Board.

MR. W. PERREN MAYCOCK.—Writing to inform us of the death of their much-esteemed colleague, Mr. W. Perren Maycock, M.I.E.E., Messrs. A. P. Lundberg & Sons say:—"After some six years' close working together, we have been enabled to fully appreciate his many good qualities and valuable assistance. He was a genuine friend to the wiring fraternity, and lost no opportunity of furthering its interests. He possessed an abundant optimism, and always argued that if a proper system of instruction could be initiated, electrical installation work would quickly occupy a respected position, instead of, as at present, being considered the Cinderella of the profession. His books and articles in the technical Press were written in such an easy style, and with an absence of bewildering mathematics, that readers had absorbed his meaning before they were aware of it. The knowledge so obtained must have been of great value to many workers, who, without his books and teaching would have remained in the dark. It was partly through his optimism that we decided to continue our switching competitions after the outbreak of war, as he held the opinion that it gave the younger ones a chance to show what they could do during their big brothers' absence on the country's work. The knowledge obtained and its application have been to many the stepping-stone to recognition in the Army, Navy, and Air Services, as letters received testify. There are many examination competitors (as well as students in his own classes in electrical installation work) who will find that they have lost a staunch friend who had their interests always uppermost in his mind."

NEW COMPANIES REGISTERED.

Coal Traction Co. (Bloxwich), Ltd. (150,798).—Private company. Registered June 24th. Capital, £3,500 in £1 shares. To construct and work tramways and other forms of traction, and to carry on the business indicated by the title. The subscribers (each with one share) are:—J. White, Jun., 8, Holyhead Road, Handsworth, Birmingham; J. Ward, 8, Park Road West, Wolverhampton, builder. The first directors are to be appointed by the subscribers. Solicitor: T. H. Cleaver, 36, Cannon Street, Birmingham.

Cliffords, Ltd. (150,828).—Private company. Registered June 27th. Capital, £2,000 in £1 shares. Merchants and factors of aircraft, wireless installations, materials, tools, machines, engines and accessories, motor cars, motor boats, electrical generators, switchboards, steam turbines, boilers, pumps, cotton, textile, and hosiery machinery, metals, metal castings, timber, hardware, &c. The subscribers are:—Clifford W. Edwards, Station Chambers, Peterborough, engineer, 50 shares; Ellen L. Taylor, Colwyn House, Peterborough, secretary, 20 shares; W. Wilson, Killarney, Leicester Road, Loughborough, 10 shares; Mrs. S. Edwards, White House, Kegworth, 10 shares. Permanent managing director: Clifford W. Edwards.

Henley's Tire & Rubber Co., Ltd. (150,905).—Private company. Registered July 5th. Capital, £200,000 in £1 shares. To take over the tire department of the business of W. T. Henley's Telegraph Works Co., Ltd., with the premises where the same is carried on, and to carry on the business of manufacturers of and dealers in wheels, rims, tires, rubber, golf, and other balls, &c. The subscribers (each with one share) are:—G. Sutton, 74, Blomfield Street, E.C., manufacturer; M. Roberts, 137, Victoria Street, S.W., civil engineer. The first directors are: G. Sutton, M. Roberts, and A. E. Salmon. A director need not be a shareholder. Remuneration, £200 each per annum (£350 for the chairman). Registered office: 18, New Union Street, E.C.

R. F. Hamilton & Co., Ltd. (150,000).—Private company. Registered July 4th. Capital, £3,000 in £1 shares. To take over the business of a scientific instrument maker and gear cutter carried on by R. F. Hamilton at 172-4, Firth Park Road, Sheffield, as R. F. Hamilton and Co.; also manufacturers of and dealers in electrical and other instruments for laboratory and works use, micro-photographic accessories, chemical balances and weights, &c. The subscribers (each with one share) are:—R. F. Hamilton, 172, Firth Park Road, Sheffield, scientific instrument maker and gear cutter; F. Atkinson, 186, Attercliffe Road, Sheffield, metallurgist. The first directors are: R. F. Hamilton, F. Atkinson, and H. Chatty. Solicitor: W. Tottle, 18, Norfolk Road, Sheffield.

Expert Metal Workers, Ltd. (150,865).—Private company. Registered July 1st. Capital, £1,000 in £1 shares. Manufacturers, treaters, depositors, and producers of metals, mechanical and electrical engineers, founders, &c. The subscribers (each with one share) are:—Miss C. H. Watts, 32, Thames Street, Sunbury-on-Thames; T. S. Ball, The Castle, Sunbury-on-Thames, company secretary. The first directors are: Sherard Cowper-Coles (permanent managing director) and T. S. Ball. Sherard Cowper-Coles has the right to nominate two directors. Registered office: 1, French Street, Sunbury-on-Thames.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Adelaide Electric Supply Co., Ltd.—Trust deed dated June 11th, 1918, constituting a floating charge on the company's undertaking in Australia to secure an issue of debenture stock, subject to trust deed of May 25th, 1911. The amount secured in the first instance is £25,000, but the company may issue further debenture stock (exclusive of premiums on redemption) up to £600,000 on the nominal amount of the issued capital, whichever is greater. In the event of the whole of the company's undertaking being purchased under the powers in the Act authorising the undertaking before June 1st, 1923, or in the event of a compulsory winding up, a premium of 10 per cent. is payable. In the event of the security being enforced against the company, a premium of 5 per cent. is payable. Trustees: Electric & General Investment Co., Ltd.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in £10 shares. Return dated June 19th, 1918. 23,600 shares taken up; £236,000 paid. Mortgages and charges: Nil.

Anglo-American Telegraph Co., Ltd. (2,891c).—Capital, £7,000,000 in £394,400 ord., £3,302,800 pref. ord., and £3,302,800 def. ord. stock. Return dated May 24th, 1918. All stock issued. £600,000 paid; £6,400,000 considered as paid. Mortgages and charges: Nil.

Morris & Lister, Ltd.—Memorandum of satisfaction in full on December 22nd, 1917, of debentures dated 1910-12, securing £6,950, has been filed.

Foster Construction Co., Ltd.—Mortgage on freehold premises at Plaistow, dated May 16th, 1918, to secure all moneys due or to become due from company to London & South-Western Bank.

Runbaken Magneto Co., Ltd.—Satisfaction in full on June 18th, 1918, of debentures dated February 29th, 1916, securing £1,000. Also filed: Particulars of £2,000 debentures, created April 19th, 1918, whole amount being issued June 20th. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

The French Cable Co.

The reasons which have induced the Compagnie Française des Cables Télégraphiques to acquire a large financial interest in a new French undertaking for wireless telegraphy, of which mention was made in this journal some time ago, were set forth in a report presented at an extraordinary general meeting which was held recently in Paris, when the ordinary share capital was increased from £537,000 to £640,000 for the purpose of this participation. It appears that the directors have been preoccupied for some years past with the progress of wireless telegraphy, and had even prepared agreements with wireless companies. The object of these agreements had been the establishment and working of stations by the company, but the arrangements failed to secure the approval of the French Postal and Telegraphic Administration in this form. Nevertheless, stations of large power had been erected in different foreign countries prior to the war, and it had been quite certain that France also would embark upon the same path within a brief period. Without prejudging the organisation which would ultimately be adopted by the French Government for the operation of French radiotelegraphic systems, and although no wireless station was yet open in France for commercial service with the United States, the directors considered that they ought not to cease to take an interest in everything which referred directly or indirectly to this question, having regard to the relations which the two systems must eventually maintain abroad, and perhaps also in France. Under these circumstances, and as soon as it was known that a French company was in process of formation—the Compagnie Générale de Télégraphie sans Fil—under first-class financial auspices, and with a large programme, the directors thought advantage should be taken of the occasion to intervene in wireless questions and obtain a sufficiently important share in the undertaking to provide the company with the means usefully to interpose in discussions which the working of wireless telegraphy might eventually raise. Owing to the control exercised by the Government over the company according to the Convention of 1901, the directors had to seek the sanction of the Ministry of Commerce, Posts and Telegraphs, and the amount required for the participation had been provisionally derived from the company's contingency fund, subject to repayment out of the capital augmentation above-mentioned. The Compagnie Générale de Télégraphie sans Fil has been formed with a share capital of £500,000, of which one-fifth has been subscribed by the Cable Co. Addressing the shareholders at the meeting, M. ERNEST MAY mentioned that until last year the company was indebted to the State, which had made advances on the basis of the revenue guaranteed by the Convention of 1901. These payments constituted a debt bearing interest, but the company no longer owed anything to the State, and another clause of the Convention has consequently come into operation. This provides that the net profits shall be distributed first by allocating 4 per cent. to the shareholders, and then by a sub-division into thirds, namely, one-third is to be placed to the contingency fund and one-third is to be devoted to the redemption by purchase of the 3½ per cent. obligations, whilst the remainder can be disposed of according as the company's statutes permit.

Callender's Cable and Construction Co., Ltd.

The directors' report, which we were able to mention only briefly last week, showed that for the year ended December, 1917, there is a balance at the credit of profit and loss of £121,784, from which are deducted interest on debenture stock, £13,500; dividend on preference shares, £10,000; appropriation for depreciation of buildings, plant and machinery, &c., £17,232, leaving £81,051 plus £249,207 brought forward, less amount transferred to reserve account, £150,000, leaving an available balance of £180,259. Out of this it is proposed to pay a dividend on the ordinary shares at the rate of 20 per cent. per annum, less income-tax, being 20s. per share, requiring £35,000, and a bonus of 5s. per share, less tax, requiring £8,750, and making a total return for the year of 25 per cent. There is carried to reserve £25,000, and carried forward, subject to excess profits duty, if any, £111,509. The ever-rising cost of raw materials and labour have rendered the carrying out of the company's operations difficult and expensive. Transport restrictions have been considerable, and in other ways the course of manufacture has been rendered difficult; but in spite of all, the company has produced an increased amount of cables and warlike stores, and is continuing to do so. Under these circumstances the results shown are satisfactory. All plant and appliances have been maintained as usual in thorough order, the expense of so doing having again increased, due not only to the high cost of labour and materials, but to the greater difficulty in keeping the machinery in running order when working under existing conditions. The operations of the Anchor Cable Co., Ltd., have again been closely bound up with those of the parent company. The workshops at Leigh have been continuously employed, day and night. The directors have had under consideration for some time past the advisability of reorganising the capital of the company, so as to bring the nominal capital more into accord with the sum actually engaged in the business. They therefore propose to increase the capital by an issue to existing ordinary shareholders, as a bonus, one new fully paid-up share of the nominal value of £5 for each £5 ordinary share now held. The necessary authorisation from the Treasury has been obtained to this issue. They have transferred to the reserve £150,000 from the amount carried over from previous years, and this, with the £100,000 previously in reserve, gives an available sum of £250,000, out of which it is proposed that £175,000 shall be capitalised against the new issue of ordinary shares. They also recommend the transfer to reserve from the profits of the present year the sum of £25,000, so as to restore the reserve to £100,000. The annual meeting was held yesterday, and an extraordinary general meeting followed for the purpose of giving effect to these recommendations. It is intended that the £5 ordinary shares shall in due course be sub-divided into £1 shares. A further number of skilled men have been called to serve with His Majesty's Forces, afloat or ashore. Twenty-six of the company's men have fallen.

Marconi International Marine Communication Co., Ltd.

At the annual meeting, on July 2nd, Mr. GODFREY C. ISAACS, who presided, said that the balance sheet showed increase in capital of £250,000, making £600,000 at the end of 1917. Debentures had been reduced from £114,360 to £112,280 by purchases during the year. General reserve account had been increased by £210,356 to £258,009. Cash at bankers and investments in war loan and in short loans against securities amounted to £410,000, as against £75,000 in 1916. Receipts from ships' telegrams, subsidies, &c., increased by £200,000 to £470,000, and profit carried to balance-sheet amounted to £192,000, as compared with £96,000, the increase in profit being due entirely to the increase in the volume of business. The 5 per cent. interim dividend paid on February 1st figures in the appropriation account, and it was proposed to declare a further dividend of 10 per cent. which would absorb £60,000. A sum of £50,000 had been placed to reserve for obsolescence of plant—this being necessary in view of the replacement of many ship stations by stations of newer design which would have to be made at the end of the war. There was reason to believe that due consideration would be given this question when excess profits were dealt with. A sum of £105,418 was carried forward, this sum being subject to excess profits duty for the years 1916 and 1917. Dividend was being paid on the increased amount of capital, although it was towards the end of the year, in order to meet the obligations which the company had entered into with the Board of Trade. By the end of the year the total number of public telegraph stations owned and worked by the company on the high seas had increased by 793 to a total of 2,265. But these figures did not give precise indication of the number of ships fitted during the period. Making similar deductions for vessels lost at sea this year, there was a further substantial increase for the first six months of this year. The total renewals increased by £218,000 to the rate of £570,000 per annum, and for the

first six months of this year they amounted to £703,374 per annum. At an extraordinary general meeting subsequently held a resolution was passed altering the articles of association to comply with the rules and regulations of the Stock Exchange in order that the company's shares may be quoted in the official list. New articles were introduced giving the company power, by an ordinary resolution in general meeting, to capitalise and distribute the whole or any part of its undivided profits.

Anglo-Argentine Tramways Co., Ltd.

At the annual meeting on July 2nd the chairman said that for the year under review the traffic receipts were £2,700,244, an increase of £47,776, in spite of serious labour troubles in the latter part of the year. The subway line had become a favourite means of transport, and in the last five months of the year traffic receipts showed an increase. Careful attention had been paid to the upkeep of overhead lines, permanent way and rolling stock, £248,754 was spent during the year on maintenance, and important economies have been made, especially in the construction of track. The board decided not to add more to the renewals reserve, as large sums were spent annually out of revenue for this purpose. A balance of £17,021, together with £50,969 brought forward from 1916, making a total of £67,990 was carried forward, and it was decided not to pay the balance dividend on the first preference shares. For the year 5s. 6d. in the £, or a sum of £216,404 was paid for income-tax. A saving of £18,000 had been made by substituting, under section 13 of the Finance Act. 1914, for the three years on which the average is calculated 1915-1917, instead of 1914-1916. The view was expressed that the preference shareholders could not hope for a dividend so long as the company was working under the existing contract with a German concern for the supply of electricity. The chairman said that the matter had not escaped the attention of the board. He did not agree that there was no chance of dividends while the contract continued, for they had been working under it for many years during which good dividends were paid. The company had a licence from the British Government to continue to receive electricity from the concern in question although it was on the black list.

General Electric Co., Ltd.

Mr. H. HIRST presided at the annual meeting held on Monday last. He said that the gratifying results of the year were not in the main due to any special war work outside their own industry. With very few exceptions, they manufactured in all their shops the same products that went through in pre-war times, with the addition of those that necessity, invention or experience had created during the war. The latter would form a basis for much fruitful development after the war. They owed their progressive results mainly to two reasons; first, their conservative policy in the past. Their generous allocations to depreciation and reserve had lowered their book values to an extreme minimum, so that, at the present moment profits need no longer be applied to the same radical degree for these purposes. Secondly, all their works had had the advantage of full employment throughout the year, with a great deal of repetition work. The advantages of this full employment and repetition work showed themselves both in higher wages to the workpeople and staff and in better returns to the shareholders. At many a general meeting in pre-war days they had dwelt on these conditions as the two essentials to cheap and efficient manufacture. It had required a world's upheaval to convince the majority of their countrymen of these first principles of production, and he hoped that this lesson might be ever present in the minds of their future legislators. In addition to the dividend of 6 per cent. on the preference shares and of 10 per cent. on the ordinary shares—the latter free of income-tax—they were suggesting a bonus to the ordinary shareholders of one ordinary share of £10 for each two ordinary shares held. This operation would be carried out by transferring from the undivided profits (reserve account) £287,500 to capital account. A resolution to this effect would be submitted to the extraordinary general meeting on July 23rd, to confirm the adoption of the new Articles of Association. This action was desirable because the ambitious programme before them demonstrated that, if the resolutions were passed, the last vestige of a private company character would, as far as the G.E.C. was concerned, have disappeared. £1,600,000 of new capital would be created, and the present shareholders were justly entitled to some of the pre-war profits accumulated at their expense before the new shareholders came in. Considering there was still a reserve left of £175,000 and a carry-forward of £145,000, whilst goodwill, patents, fixtures and installations, loose plant, tools, &c., figured in the balance-sheet at a nominal sum of one pound, the distribution to the ordinary shareholders was both just and modest. Owing to the action of the Treasury in refusing to sanction the division of the ordinary shares into denominations of £1, a difficulty arose in the distribution of the bonus shares, where a shareholder held an odd number of shares. They were making arrangements so that it would be possible to buy and sell the fractional shares which would be created. Their relations with their employés throughout their history had been excellent. In the strenuous years before the war, however, when the electrical industry had to compete against the cheapest labour markets of the world, it was not always possible to pay such wages that workers could put aside something for the proverbial rainy day. They had therefore come to the conclusion that this was the time when they could show their gratitude to those who had loyally worked in their service. They propose that £37,500 provided from the reserve fund should be vested in trustees, who would at once invest this sum in new ordinary shares of the company at par. The trusts of this fund were for the purpose of application for the superannuation, pensioning off and benefit of employés of the company or their families or dependents, in such a manner as the directors of the company might determine. They proposed to ask an advisory committee selected from the staff to assist them in the administration. It was their hope to add materially to the fund in the future. At that meeting he was reminded that he had spent 37 years in the service of the electrical industry. Thirty-two years ago they laid the foundation of what was now the G.E.C. It looked to him as if they had spent the whole thirty-two years in preparation for that day. Slowly but surely they had undertaken to develop nearly every branch of electrical work. They had sat too long and looked admiringly at the progress of their foreign rivals. He saw no reason why there should not be two, three or four great electrical concerns in this country, grouping themselves into big units out of the mass of electrical material at their disposal in order to play a better and more important part in the world's work. He could not speak for others, but, on behalf of the General Electric Co. he believed he could say that they meant to try. They thought they were ready for it. They had an unrivalled selling organisation throughout the United Kingdom. They had established affiliated companies in all the principal parts of the British Empire, and in many neutral and allied countries as well, every one of them led by men educated in their counting house or their works. They had established modern works in various parts of the country covering nearly every branch of electrical engineering. Their Witton engineering works produced every kind of dynamo and motor for power or lighting from a 20,000-H.P. turbo-generator down to the smallest electric fan. Their carbon works were unique in the country, and they had been compensated for the losses, which had been referred to at their meetings in pre-war days, by the inestimable value which these works had proved to the country during the war. Their telephone works were the first of their kind in the country that produced a complete telephone exchange equipment by British labour and materials; since their inception in 1907 others had followed in their wake. Their lamp works were the first metal filament lamp works in the country, and had as a result formed to-day the nucleus of a healthy and growing British industry, possessed of great possibilities. Their switchgear, tube, fixtures and brass works were amongst the most important of their kind in the country. The cable works in which they were interested were now in full swing, and their magneto works had just commenced a useful and much-wanted output. Would they pardon him for enumerating this impressive list of enterprises with some sense of personal pride? His colleagues, eight of whom commenced their careers in subordinate positions in their business, would bear him out that so convinced was he that his vision would lead him right that he frequently incurred in the eyes of others considerable risks. Nearly every one of these works at the time of their inception meant the planting of a new industry, or the introduction of new methods or designs into the country, and every one required the training of unskilled labour or education of skilled labour to new processes. The fascination of this picture lay not only in the creation of hives of industry on what was not many years ago virgin soil—and the gratifying financial results—but it was the independence of each of these works of foreign assistance. It had not always been appreciated that all works required, besides raw material, certain basic materials which had to be manufactured and which most works used to import. The telephone factory required, for instance, ebonite. They put down an ebonite plant before the war and had been able, not only to supply themselves, but competitors and other trades. The carbon works required soot as a basic raw material. Some time before the outbreak of the war they acquired the process of making soot in which their foreign competitors managed to establish a monopoly. The use of this product in other industries had extended so rapidly during the war that, at the request of a Government department, they had increased that factory fourfold during the last two years, and, whenever circumstances permitted of their starting the laboratories for which they had put aside a credit some years ago, and when they could instal in them the brains which at present were employed in evolving processes of destruction, they anticipated a still larger development in this industry for a variety of purposes. Their engineering works had also developed the production of mica and other insulating materials which were essential for the production of good electrical machines. Their lamp works were able to produce their own tungsten wire, manufacture their own lamp-caps, and had their own glass-blowing works. The latter enjoyed for many years the jealous attention of their foreign competitors, and tempting offers of purchase were made by them, presumably for the purpose of shutting them down. They determined to keep them going at a loss rather than lose their independence, and here again their tenacity had been more than compensated. No works had been more useful since the outbreak of the war. When some day D.O.R.A.'s seal was removed from their lips they would have many an interesting story to tell. Conditions

of labour had prevented them from getting the increased output that was required of these works in spite of a considerable capital expenditure on new furnaces and new buildings. They, however, were aware of some labour-saving automatic bulb-blowing machines invented in America, for the rights of which Germany negotiated before America joined the Allies. With the co-operation of Mr. Dudley Docker, of the Metropolitan Carriage, Wagon & Finance Co., ever in the vanguard of British industrial progress, they secured the rights for these machines for this country by paying £50,000 for the patents and purchasing a number of machines which would be installed under the direct supervision of experienced American erectors. Thanks to the assistance of the Board of Trade and other Government departments, these machines were expected to arrive shortly, and they hoped they would be the means of firmly settling the glass bulb industry in this country once and for all. They had an option of acquiring, together with the Metropolitan Carriage, Wagon and Finance Co., machines for other branches of the glass industry. It would depend on the working of the present machines whether they exercised that option or not. He could enumerate a good many more of these essential though subsidiary enterprises, but he had said enough to give shareholders an idea as to how their money was being invested. If the electrical industry was to rise to the level expected of it, and not to drift back again into a state of industrial dependence, it must make itself independent of foreign importation and develop all its requirements from raw materials and resources which the Empire placed at its disposal. In that direction great opportunities would be afforded for science; furthermore, in co-operation with labour, and prudent finance, research, and invention, they would be able to take their full share in securing improvement in the social and economic conditions of the country. The electrical industry in the future would not be content to be a mere adjunct to other industries—it would have to be a "key" industry by itself. Industrial penetration, of which they had heard so much of late, had been carried out by Germany, who had used the electrical industry as a key. If electrical concerns were to open the door for British enterprise abroad they must in future be enabled to carry out complete contracts. It was little realised that average electrical contracts brought as a rule only 10 per cent. or 15 per cent. of work into purely electrical shops. The work connected with it automatically brought 85 per cent. or 90 per cent. of work into engineering and other industries. Firms that had carried out the lighting and power installations of Berlin or Chicago had a better opportunity of securing foreign contracts than British firms, which, although their complete range of products might be equally good or better, could only show that they had carried out a section of an installation at Manchester, Glasgow, or Birmingham. He wished some attention to this necessity had been visible in the recent report on the organisation of super-stations contemplated in this country. Firmly convinced that these changes would take place they had had to change their policy somewhat. All the works they owned or controlled had been built, started and developed by their own initiative, and therefore they took much pride in them. The war having of necessity prevented their realising the ideal of being efficient in every branch of electrical engineering by the means they had originally planned, they had decided on another *modus operandi* in order to be ready when the great work of reconstruction began. What therefore was denied to them both by time and restrictions to build for themselves, they must acquire by purchase. In accordance with this policy they had acquired the ordinary shares in Messrs. Chamberlain & Hookham, Ltd., one of the most prominent electricity meter manufacturers in the country. This was also the reason why they had acquired the works of Messrs. Fraser & Chalmers, Ltd., at Erith. That firm had gained a splendid engineering reputation, and without a doubt would have greater chances of development in conjunction with an electrical firm such as the General Electric Co. The acquisition brought to them certain departments which in the light of the above programme were a necessity, but it brought also other departments which opened up to them fresh fields of enterprise. The beauty of this programme was that, from a national point of view it was efficient; it overlapped very little, if at all, the schemes and projects of other big electrical concerns. They would not be surprised that, to carry out these different schemes they required additional capital. They would therefore hold an extraordinary general meeting immediately after this meeting, when they would submit for their approval a resolution increasing the capital of the company to £3,000,000 by the creation of 100,000 additional preference shares of £10 each, and 60,000 additional ordinary shares of £10 each. The directors proposed to issue to the public 80,000 of these preference shares and 16,000 of the ordinary shares on the terms of a prospectus which would shortly be issued. A further 4,000 ordinary shares of £10 each would be reserved for issue to directors and employés at the same price as it was proposed to issue them to the public. The remainder would be required for certain essential transactions already under contemplation, but upon which it would be premature to dwell that day. As explained in the original notice calling the extraordinary general meeting, the directors would submit for their approval a consolidated and revised edition of the Articles of Association which were better adapted to a company of this size. The ordinary shareholders had always shown their consideration for the preference shareholders, first by voluntarily raising the dividend from 5 per cent. to 6 per cent.—last year by refunding the income-tax—and now they proposed further to raise the preference dividend from 6 per cent. to 6½ per cent. He had endeavoured to lay before them the main outlines of their programme. It would be obvious that some of the projects they had in view would have to wait until the return of their 2,000 men who were at the Front, but it was also clear that the opportunity for quickly reinstating them was available. If his address spelt optimism, it was due to the feeling that the big task in front of them was made easy by local colleagues and devoted and enthusiastic staff. They were doing work of great national importance, and were helping to lay the foundation of an industrial realm within the borders of which untold thousands after them would find elevating and ennobling activities and ideals.

Mr. E. G. BYNG seconded the adoption of the report, and it was adopted. Resolutions were subsequently passed appointing Major-Gen. Sir Newton Moore and Mr. A. Chamberlain directors. Sir Newton Moore, in the course of a speech, said that the directors had, in his opinion, laid down a sound progressive policy.

British Thomson-Houston Co., Ltd.

The report of directors for 1917 shows as follows:—The buildings and machinery of the company have been maintained in good condition throughout the year. The works at Coventry which have heretofore been held on lease have now been purchased by the company under the terms of an option contained in the lease. The large canteen at the Rugby works, mentioned in the last annual report, has been completed. For the year 1916, as stated in the last annual report, it was not possible to take an inventory at the Rugby main factory and the Willesden factory, and in the accounts for that year the book figures were used. A complete inventory was taken in the usual way at all the factories and branch offices at the end of the year under review, and the book figures for 1916 were found to be fully justified. The profits for the year, after deducting all expenses and charges other than interest on debentures and loans, and after making provision for estimated war taxation for the year, are £329,664, plus £163,923 brought forward, less estimated provision to end of 1916 for munitions levy and excess profits duty £150,000. Interest on debentures and loans absorbs £95,745, leaving £247,842 out of which the directors recommend that there be appropriated for depreciations and reserves £194,098, leaving to carry forward £53,744. In the balance-sheet for 1916 the remainder of the cost of "goodwill, patents and licences," after taking into consideration the amounts previously written off, was £100,636. There was written off in that balance-sheet £40,636, leaving a net amount of £60,000. It has now been decided to restore the items comprising this account to their original cost, namely, £219,844. Also in the case of "office furniture and equipment of storerooms," which had been written down to £1, it has been decided to reinstate part of the amounts heretofore written off, and, pending a valuation, this account now stands at £20,000. On the other side of the balance-sheet there has been created a capital reserve account, consisting of the amounts reinstated in the two accounts above mentioned, viz., £157,959, to which has been added from this year's profits £80,000, the total capital reserve account thus standing at £237,959. The book value of the factories and their equipment is under consideration. Under the terms of the trust deed securing the issue of the company's debentures, the company since the beginning of this year has paid to the trustees the sum of £5,565, which was applied by them in redeeming at 105 by drawings £5,300 debentures. The total par value of debentures redeemed to date is £43,805, and leaves a net amount outstanding at the date of this report of £168,195. The amount outstanding at December 31st, 1917, was £173,495. The directors have followed their usual practice in making reserves to cover risks in connection with bad debts and other contingencies. The Rt. Hon. Lord Carmichael, G.C.S.I., G.C.I.E., K.C.M.G., has joined the board.

Meeting: London, July 17th.

Swiss Companies.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, records net profits of £139,000 for 1917 on ordinary share capital of £1,000,000, as contrasted with £74,000 in the preceding year. A dividend at the rate of 4 per cent. is recommended, being the same as in 1916.

The "Motor," A. G. fur Angewandte Elektrizitat, of Baden, which is an investment company belonging to the Brown-Boveri group, states that all the supply works experienced a pressing demand for energy in 1917, and the cost of production increased, without, however, its being possible to obtain adequate compensation in higher prices for supply. As net profits the accounts indicate the sum of £91,000, as in the previous year, and the dividend on the ordinary share capital of £1,200,000 remains at 7 per cent., as in each of the years since 1911.

The report of the *Schweizerische Gesellschaft fur Elektrische Industrie, of Basle*, states that the directors were able to make arrangements in 1917 for the covering of the depreciation in the currency in the case of a considerable portion of the company's long-term investments in foreign currency. After making provision for depreciation, the accounts show gross profits of £124,000, as contrasted with £125,000 in 1916, the whole of which in each year has been absorbed by the payment of interest on the loan capital of £2,400,000, and the

defraying of general expenses and of taxes. The ordinary capital of £800,000 thus receives no dividend for the past two years.

Some Spanish Companies.

Our Spanish correspondent reports as follows:—

The Electro-Industrial Corunesa.—The accounts of this company for the year 1917 show receipts £22,120, expenses £5,188, net profits £16,932. A dividend of 11 per cent. has been declared, as against 10 per cent. for several preceding years. £6,160 was placed to the amortisation fund, and £1,360 carried forward. The capital of the company is £86,000. The year 1917 was the twelfth and most successful in the history of the company. The hydro plant at Capela furnished all the power necessary without having to make use of the reserve steam station. Nearly all the energy developed is sold in bulk to two subsidiary companies which supply electricity to the towns of Vigo, Coruna, and Ferrol. There is a growing demand for current in the dockyards of Ferrol.

Sociedad General Gallega de Electricidad.—A dividend of 7 per cent. is proposed. The directors report that many new consumers were connected during 1917, but this increased business was balanced by the increased cost of fuel and other materials, and higher wages to staff. Also, the severe drought of last autumn had an adverse effect on the running of water-driven plant, and the reserve steam station was employed for a longer period last year, thus increasing the fuel bill by £2,500 over the previous year. The company have obtained permission to utilise an additional 1,500 litres per second (at 151 metres head) at the Fervenza waterfall, and for this purpose have just bought a 1,750-H.P. Escher-Wyss Brown-Boveri unit. The overhead network is being extended to supply a further 400 H.P. to the naval workshops at Grana.

Saragosa United.—A dividend of 6 per cent. has been declared. Owing to the drought of last autumn and the severe frosts last December it was not possible to give a continuous supply to all consumers, and for the same reasons the calcium carbide factory owned by the company produced 145 tons less than the preceding year, and through railway deficiencies disposed of 359 tons less. The demand for electricity is increasing, 53 new power consumers having been added, and 650 lighting consumers. The public lighting scheme is completed. Energy for this is being supplied at 5 centimes (one halfpenny) per unit. The company is considering the question of developing fresh water powers in the district.

Eléctrica Irurak-Bat.—The directors propose a dividend of 4 per cent. They report increased sales of electricity, and also increased running and repair costs.

Unión Eléctrica de Cartagena.—The total receipts for 1917 were £61,616, and expenses £44,324. A dividend of 4 per cent. was declared, making with the 3½ per cent. already paid 7½ per cent. for the year.

French Companies.

The Société Francaise des Electrodes reports profits of £32,000 for 1917. After allocating £17,000 to depreciation, the directors recommend the payment of a dividend of £1 8s. per share.

The Société pour l'Industrie Electrique states that the profits realised in 1917 amounted to £35,000, as against £33,000 in 1916. Including the balance brought forward, the sum at disposal is £39,000, which has been transferred to the profit reserve fund, which now totals £107,000.

The directors of the *Société Electro-Chimique du Giffre* report profits of £56,000 for 1917, as contrasted with £27,000 in the previous year. It is proposed to distribute £2 16s. per share, as against £2 8s. in 1916, and to apply a portion of the reserve fund of £74,000 to the part payment of a new issue of shares in contemplation.

The receipts of the *Chemin de Fer Nord-Sud, of Paris*, amounted to £601,000 in 1917, or £110,000 more than in the preceding year. On the other hand, the working expenses increased almost in the same proportion owing to the high cost of raw materials and wages, whilst the financial charges were greater than in 1916. The net profits total £22,000, which sum has been carried forward, and no distribution is proposed, as in the previous year.

The Société d'Electro-Chimie reports gross profits of £93,000 for 1917, as compared with £151,000 in the preceding year, war taxation having been first deducted from the former total. After having made provision for depreciation, the accounts show an available balance of £50,000, as against £55,000 in 1916, and the directors propose a dividend at the rate of £2 per share for 1917.

The Compagnie du Chemin de Fer Métropolitain de Paris reports a further expansion in the traffic in 1917, but the working expenses also increased very largely owing to the dearness of coal and other raw materials, and of labour. The net profits and balance forward are £219,000. After placing 5 per cent. of the net profits to the legal reserve fund, and setting aside £39,000 for the redemption of shares, a dividend at the rate of 5.6 per cent. has been declared on the ordinary share capital, leaving £48,000 to be carried forward.

The Compagnie Continentale Edison, of Paris, reports gross profits of £40,000 for 1917, as contrasted with £62,000 in the previous year, and net profits of £22,000, as against £18,000, the total balance available for last year with the amount brought forward being £28,000. A year ago a dividend at the rate of 16s. per share was declared, but as it is necessary to strengthen the financial position it is yet uncertain whether any distribution will be made for 1917.

German Companies.

The Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, proposes to pay a dividend of 5 per cent. for 1917, being the same rate as in the preceding year.

The directors of the *Deutsch-Atlantische Telegraphen Gesellschaft, of Cologne*, recommend a dividend of 3½ per cent. for 1917, this comparing with a rate of 4 per cent. in the previous 12 months.

The report of the *Julius Pintsch A.G., of Berlin*, states that the manufacturing profits continued the declining tendency in 1917, and the gross proceeds approximated to those realised in the preceding year solely as a result of the larger turnover. As it was only necessary to appropriate £51,000 for depreciation, as against £126,000 in 1916, the net profits total £134,000, as compared with £93,000, and the directors recommend a dividend of 14 per cent., this rate contrasting with 10 per cent. in 1916.

The Concordia Elektrizitats A.G., of Dusseldorf, reports that a portion of the works extensions at Dortmund was brought into use in 1917. As net profits the accounts indicate the sum of £9,100, as compared with £8,800 in 1916, and the directors recommend the payment of a dividend at the rate of 12½ per cent. on share capital of £50,000, this contrasting with 7½ per cent. in the previous year. It is now proposed to increase the share capital to £100,000 to provide for the extension of business.

The Treuhand Bank fur die Elektrische Industrie A.G., of Berlin, which was originally constituted by the former Felten and Guilleaume-Lahmeyer Werke, and which is now a trust company of the A.E.G., reports gross profits of £46,000 on investments in 1917, as compared with £45,000 in the previous 12 months. After meeting interest charges the net profits and balance forward are returned at £37,000, as against £40,000 in 1916. It is proposed to pay a dividend of 4½ per cent. on the paid-up capital of £500,000, the rate in the preceding year having been 4 per cent.

The A.E.G. Schnell Bahn A.G., of Berlin, whose railway is said to be still in course of construction at Berlin, reports the intention to pay interest at the rate of 4½ per cent. on the £1,000,000 ordinary shares for 1917, as in the previous year, whilst the A.E.G. is again to pay 5 per cent. on the £1,125,000 preference shares. It is now intended to increase the latter class of capital by £300,000, and to seek authority to continue the payment of interest during construction on the ordinary shares also for the years 1918 and 1919.

The report of *Hartmann & Braun A.G., of Frankfort-on-Main*, states that the turnover in 1917 largely exceeded that of previous years, and was almost exclusively composed of articles for the national defence. The gross profits, which amounted to £142,000 in 1916, rose to £178,000 last year, and the net profits advanced from £49,000 to £51,000 in the two years respectively. The directors recommend a dividend at the rate of 15 per cent., as compared with 14 per cent. in 1916, and with the further issue of new gratis shares the rate becomes increased to 29½ per cent., as against 34 per cent. in 1916, when similar shares were also presented to the proprietors.

The report of the *Gesellschaft fur Elektrische Unternehmungen, of Berlin*, which owns supply works, and is also interested in others, refers to the difficulties experienced in securing alterations in contracts so as to obtain higher prices which would equalise the dearness of fuel and other raw materials, and of labour, and suggests that the Imperial authorities should intervene and legally regulate the rates charged for energy. On the other hand, the tramways yielded more favourable results in 1917, and the company was also able to dispose at a profit of certain investments in the Bologna supply works and the Electric and Traffic Undertakings Co., of Buda Pesth. After meeting interest charges on the loans of £1,940,000, and defraying general expenses, taxes, &c., the accounts show net profits of £185,000, or the same amount as in 1916, and the dividend is at the rate of 5 per cent. on the share capital of £3,000,000. This compares with 5 per cent. in 1916 and 6 per cent. each in 1915 and 1914. It is stated that the company has again got in touch with its Russian undertakings, but it is uncertain whether possession will be resumed or claims lodged for compensation.

Siemens Bros. & Co., Ltd.—At an extraordinary general meeting on July 9th, it was resolved that each of the existing shares of £5 each be subdivided into five fully-paid shares of £1 each, and that the share capital of the company be increased to £1,500,000 by the creation of 900,000 shares of £1 each. Treasury consent is to be applied for.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended June 30th of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less tax.

Direct U.S. Cable Co., Ltd.—Interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum, for the quarter.

Dublin United Tramways (1896), Ltd.—Interim dividend 4 per cent. per annum, less tax, on ordinary stock for half-year.

Fraser & Chalmers, Ltd.—Dividend of 7½ per cent., less tax, on the preference shares.

Chile Telephone Co., Ltd.—During the year ended March, 1918, the aggregate number of subscribers at all centres increased by 1,177 to 15,420. The gross revenue was £213,140, an increase of £60,958. The total expenditure (exclusive of income-tax) was £129,187, an increase of £36,590. The net revenue was £83,953, an increase of £24,368. £7,000 is placed to general reserve, £20,000 to reserve for renewal of plant, and after dividends of 3s. (interim) and 5s. (final) per share, free of tax, on the shares are paid, £24,289 remains to carry forward, subject to excess profits tax. The exchange adjustment account shows a credit balance of £12,375, the rate of exchange at March, 1918, being 15¼d., as compared with 10¾d. at March, 1917. In order that the nominal capital may approximate more closely to the actual capital expended, the directors propose to transfer from the general reserve to capital account £110,000, and distribute the equivalent to the shareholders in 22,000 fully-paid £5 ordinary shares in the proportion of one share to every three shares held. Treasury sanction has been obtained.

Rangoon Electric Tramway and Supply Co., Ltd.—Sir FREDERIC W. R. FRYER presided at the annual meeting on June 27th. He said that after providing for interest on debenture issues, dividend on preference capital, and the several allocations enumerated in the report, there remained £9,568 from which the directors recommended payment on the ordinary share capital of 3 per cent. (free of income-tax), carrying forward £4,258, an increase of nearly £1,300 compared with last year. While some economy had been effected in other branches of expenditure, the increase in power house expenses of £6,515 was attributable to the higher price of coal. The increase in tramway receipts was £4,500, and the cars travelled 119,801 more miles, carrying nearly 50 per cent. more passengers than in 1916. The private lighting and power department showed a small though steady increase, and alterations were being carried out which would greatly improve public lighting in the city of Rangoon.

Crompton & Co., Ltd.—A dividend of 7 per cent. on the ordinary shares for the year ended March, 1918, is to be paid, as against 5 per cent. last year.

Edmundsons' Electricity Corporation, Ltd.—After providing for income-tax and mortgage and debenture stock charges, the net profit for 1917 is £12,209, against £12,294 for 1916. After paying the dividend on the cumulative preference shares, £5,128 is to be carried forward.

Lima Light, Power & Tramways Co.—Dividend of 1½ per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

THERE is a noticeable continuance of the good tone in most markets, and the inactivity on the part of the Germans in starting their new offensive is held to be all to the good of the Allies. It has had the effect of quickening interest in industrials, where the greater part of Stock Exchange business is being transacted. Manufacturing shares stand out with particular prominence for their strength, General Electrics, for instance, having risen to 26¼. Another feature is a fresh advance in the Underground Railway stocks. In the telegraph section, prices hold their ground, and further gains have been secured by Callenders, Telegraph Constructions, and one or two others.

Districts have risen to 19, and Metropolitans have been a remarkably good market, with a rise of 2 points to 24¼. Underground Electric Income bonds followed up their rise of 3 points last week with a further gain of 2¼ this week. The "A" shares are also better. Central London stocks are quiet, but a little demand for them found there was hardly any floating supply in the market. Other home railway stocks are strong, the attention of the investor being turned to this market by the imminence of the dividend announcements, and the fact that at current prices good returns are still obtainable. The prospect of what is likely to happen after the end of the war is so obscure that people have given up attempting to prophesy, and are content to buy stocks, taking what chance there may be of Labour troubles in the future.

The Callender's Cable & Construction Co. has raised its dividend from 20 per cent. to 25 per cent. for the year, and details are now issued as to the bonus in shares which was announced earlier in the year. One new share is to be given for every old share at present held. As in the case of the General Electric Co., the Callender board intended to split the £5 shares into new ones of £1 denomination, but the Treasury came down on this scheme also, and refused permission for the shares to be split. For 1917, the company made just over £91,000 net, an increase of £4,200 over the 1916 figure. The reserve is raised to £100,000, and £111,000 goes forward to the new accounts. From all of which it is obvious that the Callender's Co. has done remarkably well, and occupies an extremely strong financial position. General Electrics, as already noted, have risen to 26¼, after a momentary spasm of indecision upon the refusal of the Treasury to allow of the splitting scheme. The Preference shares advanced 10s. to 11; the meeting was regarded as very satisfactory. Telegraph Constructions have gone up 30s. to 44, and all things considered, it is natural enough that there should be some expectation as to the company falling into line with others, and distributing some kind of a share bonus. Edison Swans have hardened to 40s. British Westinghouse Preference and others of this group maintain their improvements, and the optimists talk hopefully on the probability of further rises which they consider are likely to take place in the prices.

The rise in Mexicans has halted, and so far as the railway stocks are concerned, a disposition has developed to allow prices to droop a little after their recent big advance. The Utilities are maintaining their ground pretty well, though it is found easier to buy bonds to-day that it was a week ago. Monterey Fives are 2 points higher at 40¼, but Pachucas went back to 42½. Brazil Tractions are down a point. The British Columbia Electric group is somewhat heavy.

Scarcely a ripple has disturbed the course of the market in home electricity shares. If anything, prices lean slightly to the easier side, there being a little talk of the possibility of dividend reductions. Gas stocks have given way lately, and this has affected the electric light list sympathetically, although, as mentioned here before, those companies which are doing a good power business are not likely to be greatly affected by the rationing order, which links together coal, electricity, and gas. Telegraphs and telephones are good, with a rise to 3½ in Marconis as a prominent feature. Other members of the Marconi group are rather harder.

Babcock & Wilcox spurted to 3 9/16, a rise of 3/16, and British Aluminium at 35s. are 1/16 higher. Rubber shares have taken a turn for the better, partly on an advance in the price of the raw material to 2s. 3d. per lb. Amongst armament shares there is not much doing, and the base-metal groups are equally quiet.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price July 9, 1918.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	6¾	—	£7 13 10
Charing Cross Ordinary	5	4	3½	—	6 3 1
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3¾	—	8 0 0
City of London	8	8	11	— ½	7 5 6
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10½	—	6 16 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5½	—	6 13 4
London Electric	Nil	Nil	1¼	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3¾	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½xd	—	7 4 0
St. James' and Pall Mall	8	9	6¾	—	6 11 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¾	—	7 7 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	95	+ ½	6 6 4
do. Def.	1½	1½	22	—	6 14 10
Chile Telephone	8	8	9½	—	4 6 6
Cuba Sub. Ord.	7	7	9½	—	*7 3 7
Eastern Extension	8	8	15½	—	5 1 7
Eastern Tel. Ord.	8	8	159½	—	*5 0 4
Globe Tel. and T. Ord.	7	—	14½	—	*4 15 0
do. do. Pref.	6	6	10	—	6 0 0
Great Northern Tel.	24	22	38	+ 1	5 15 9
Indo-European	13	—	49½	—	6 5 1
Marconi	15	—	3⅜	+ ⅛	4 5 10
Oriental Telephone Ord.	10	—	4 1/16	— 1/16	2 1 9
United R. Plate Tel.	8	8	7½	—	*5 10 5
West India and Panama	6d.	9d.	1⅛	—	*8 6 8
Western Telegraph	8	8	15⅞	—	*5 0 10
HOME RAILS.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	24½	+2	4 2 6
do. District	Nil	Nil	19	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	6⅜	+9d.	Nil
do. do. Income	6	4	88	+2½	*4 16 5
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	64	+1	7 14 10
Brazil Tractions	—	—	42	—1	—
Bombay Electric Pref.	6	6	95	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	62½	—	8 0 0
do. do. Preferred	Nil	Nil	46½	—1	Nil
do. do. Deferred	Nil	Nil	40	—	Nil
do. do. Deb.	4½	4½	61⅛	—1½	6 18 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	45½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	36½	—	Nil
Mexican Light Common	Nil	Nil	21	—1	Nil
do. Pref.	Nil	Nil	32½	—	Nil
do. 1st Bonds	Nil	Nil	48	+1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3 3/16	+ 3/16	4 4 0
British Aluminium Ord.	10	10	1⅞	+ 1/16	5 14 3
British Insulated Ord.	20	20	1¼xd	—	5 6 8
British Westinghouse Pref.	7½	7½	2⅝	—	5 14 3
Callenders	20	25	19½	+1	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 7/16	—	5 16 0
Edison-Swan, fully paid	—	—	38	—	Nil
do. do. 4 per cent. Deb.	4	4	74½	—	5 7 5
Electric Construction	7½	10	1 7/16	—	7 12 4
Gen. Elec. Pref.	6	6	11	+ ¾	5 9 1
do. Ord.	10	16	26¼	+1	*3 15 6
Henley	25	25	21½	—	5 17 8
do. 4½ Pref.	4½	4½	8½	—	5 12 2
India-Rubber	10	10	16½	—	*6 4 0
Telegraph Con.	20	20	44	+1½	*5 8 8

*Dividends paid free of Income Tax.

NEW ELECTRIC PASSENGER LOCOMOTIVES.

(*Continued from Vol. 82, page 598.*)

The gearless locomotive now under construction in the General Electric shops for the Chicago, Milwaukee & St. Paul Co.'s extension to Settle is equipped with 14 axles, 12 of which are drivers, and two guiding axles. The armature is mounted directly upon the axle and, with the wheels, constitutes the only dead or non-spring borne weight of the locomotive. This weight is approximately 9,500 lb., as compared with 17,000 lb. deadweight on the driving axles of the present geared locomotives now in operation on that road. The two fields are carried upon the truck springs with full freedom for vertical plan of the armature between them.

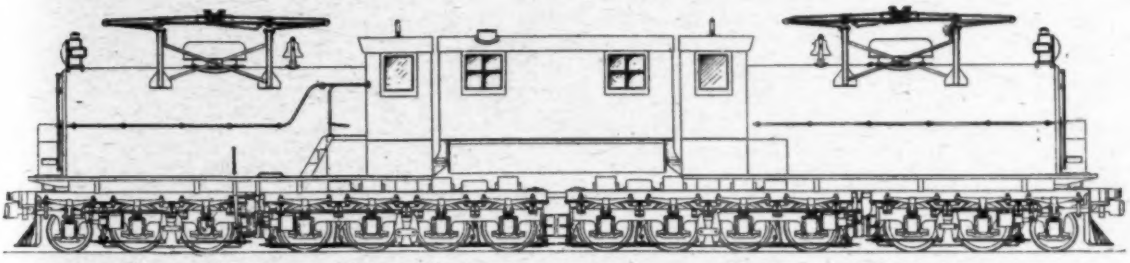

FIG. 4.—ELEVATION OF GEARLESS LOCOMOTIVE FOR THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

The construction of the motors throughout is practically identical with that employed upon the New York Central gearless locomotives, but the capacity of the locomotive is much increased, and the wheel arrangement somewhat different. The following are the general physical characteristics of the locomotives now under construction:—

Length inside knuckles	76 ft. 0 in.
Length over cab	68 ft. 0 in.
Total wheel base	67 ft. 0 in.
Rigid wheel base	13 ft. 11 in.
Diameter driving wheels	44 in.
Diameter guiding wheels	36 in.
Approximate height centre of gravity	57 in.
Weight of electrical equipment	235,000 lb.
Weight of mechanical equipment	295,000 lb.
Weight of complete locomotive	530,000 lb.
Weight on drivers	458,000 lb.
Weight on guiding axle	36,000 lb.
Weight on each driving axle	38,000 lb.
Dead or non-springborne weight per axle	9,500 lb.

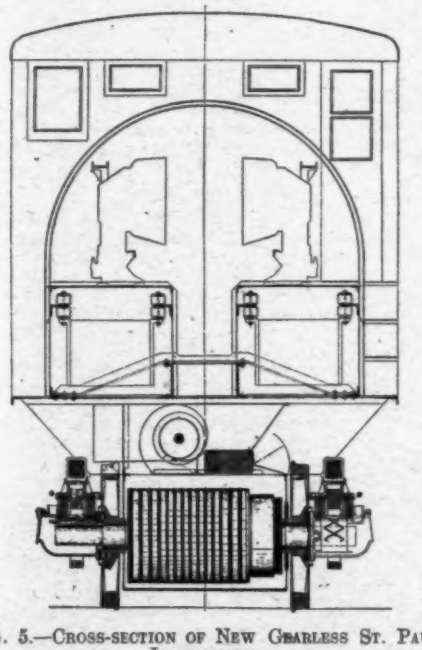

FIG. 5.—CROSS-SECTION OF NEW GEARLESS ST. PAUL LOCOMOTIVE.

With 12 motors per locomotive available for different control combinations, there is a possibility of securing a wide range of speeds to meet the varying conditions of passenger train operation. Motors are connected three in series, giving 1,000 volts per commutator for full-speed operation, but the control also permits a connection of four, six, and 12 motors in series for fractional speed operation. Further provision for variable speed is made by shunting the motor fields in all combinations of motors, but it is probable that the greatest value of field shunt will be obtained with the full-speed connection of three motors in series.

It is especially desirable that a passenger locomotive shall have sufficient weight on the drivers and reserve motor power to haul additional train weight on occasion, and in this respect the gearless locomotive under construction presents some attractive possibilities. The manufacturer's guarantees cover the operation of a 12-car train weighing 960 tons against an adverse grade of 2 per cent. at a speed of 25 M.P.H. Under these conditions there is a demand for 55,200 lb. tractive effort at the rim of the drivers, and equivalent to 12 per cent. coefficient of adhesion of the weight upon the drivers. There is, therefore, ample margin both in weight upon drivers and capacity of the motors to haul not only 12 cars, but on occasion 13 or 14 cars, with practically no sacrifice in schedule speed, and without overloading the motors or exceeding known and conservative practice as regards loading of driving wheels. For example, the gearless locomotive being built will permit the starting of a 12-car train on a 2 per cent. grade with a coefficient of adhesion of only 20 per cent., and accelerates the train at 0.3 M.P.H. per second.

While the manufacturing guarantees are limited to 42,000 lb. tractive effort as a continuous output of this locomotive, preliminary tests upon a sample motor built indicate that a complete locomotive when finished may show values materially higher than the guarantees made. This fact is of the greatest importance, and holds out wide visions of radical changes in the operation of trans-continental trains, both passenger and freight.

The total weight upon drivers of 458,000 lb. is practically the same as the driver weight of the freight locomotive now in operation on the Chicago, Milwaukee & St. Paul Railway. If, therefore, the completed locomotive meets the expectations of the builder, it offers the possibility of using the same locomotive interchangeably for both passenger and freight service.

The considerable speed variation permitted with four motor combinations ensures a means of operating the locomotive at

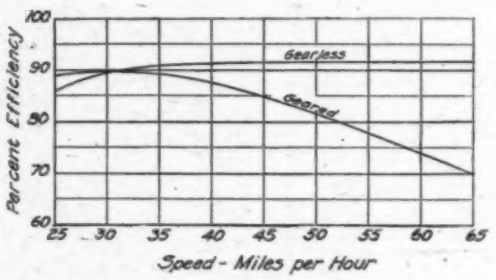

FIG. 6.—EFFICIENCY CURVES OF PRESENT GEARED AND FUTURE GEARLESS ST. PAUL LOCOMOTIVES.

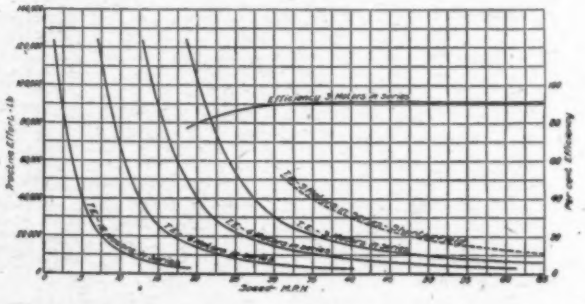

FIG. 7.—CURVES OF TRACTIVE EFFORT AND EFFICIENCY PLOTTED AGAINST SPEED, ST. PAUL GEARLESS LOCOMOTIVES.

any speed demanded by the character of service to which it is assigned. Furthermore, when operating a freight train at lower speeds it can reasonably be expected that the tractive effort rating of the locomotive will be increased, due to the lower core loss at the lower armature speeds. While not primarily designed as an interchangeable locomotive, it is quite possible that the flexibility of this new gearless locomotive will become apparent when it is put into operation, and its fitness for freight service will be fully recognised.

The control of the gearless locomotive will in many respects be a duplicate of that now in successful operation on the geared motor locomotive previously installed. Provision will be made for regenerative electric braking on down grades, as the success and operating value of this method of holding trains on down grades has been fully established during the past two years of electrical operation on the Chicago, Milwaukee & St. Paul Railway. The geared locomotives now operating utilise a motor-generator set for the purpose of motor field excitation while regenerating, and the results with this combination have been excellent. Careful experiments made during the past two years have demonstrated that motor-generator field excitation is not essential, and the control for the new gearless locomotive will dispense with this feature. This simplification of the control and reduction in weight and cost constitutes a marked improvement.

One of the greatest arguments for electrification is the saving of fuel effected, and therefore it is very essential that the efficiency of electric locomotives be raised as high as possible, in order to fulfil one of the claims for their introduction.

The geared locomotive operates at a high efficiency in heavy freight service where pushers are used on up grades, but accumulative gear losses result in a low all-day efficiency of a geared locomotive in passenger service, when the profile is broken and contains long stretches of practically level track. On the other hand, the gearless motor operates at highest efficiency on level track or lesser grades, and it is this class of service that constitutes the bulk of the all-day duty of a passenger locomotive.

A comparison of the efficiencies of the present geared locomotive of the St. Paul road and the gearless locomotive under construction is presented in the curves shown in fig. 6, which are plotted with speed as abscissæ. The average operating speed at about 50 M.P.H. shows a gain of 10 per cent. in efficiency of the gearless locomotive as compared with the geared type, and throughout the entire range of speed from 30 M.P.H. up, the gearless locomotive will operate at over 90 per cent. efficiency, as compared with drooping characteristic of the geared-motor locomotive.

It is proper to note that the considerable gain in efficiency resulting from the adoption of the gearless motor is due almost entirely to the elimination of the mechanical losses inherent with geared motor drive. The exclusion of mechanical parts is followed by an attractive increase in reliability and a marked reduction in maintenance expense. It is felt, therefore, that the introduction of the gearless locomotive upon the Chicago, Milwaukee & St. Paul marks a distinct advance in electric railroading, and this type of construction, now for the first time made possible for mountain service, will result in a marked improvement in the method of handling both passenger and freight trains in this most difficult class of railroad service.

(To be concluded.)

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

Annual Convention.

(Concluded from page 8.)

Annual Report.

The annual report of the Council stated that the membership of the Association stood at 385, an increase of 10.

With regard to electric power supply, the Board of Trade Committee invited the I.M.E.A. to give evidence on this subject, and the Hon. Secretary, Mr. Faraday Proctor, was delegated by the Council for this purpose. A committee was also appointed to deal with the subject, and a statement agreed upon by the Association of Municipal Corporations and the Council of the I.M.E.A. was issued stating, *inter alia*, that in order to ensure that there should be an adequate and economical supply of electric power it was necessary that the areas of supply, instead of being local government areas, should be areas specially delimited as areas suitable for electric supply, having regard to demand and facilities for obtaining suitable sites for generating stations. Generation and distribution need not in all cases be in the same hands. Generation should be on a large scale, and extend over a considerable area. Distribution might conveniently be organised in smaller areas. The new areas, both for generation and distribution, should be continuous, and would in many cases include within their limits places which at present were without a supply, either because no powers existed there or because existing powers had not been exercised. The best use possible should be made of existing systems of generation, transmission, and distribution, and also of the local knowledge obtained by established undertakings. When the whole or a portion of an existing undertaking was transferred to a larger authority, suitable provision would be made in regard to the rights and obligations of existing undertakings, the capital commitments and the responsibilities towards any officers whose status or remuneration would be affected. Undertakings of this description, which involved a monopoly, and upon which the prosperity of the people depended so largely, should be entirely in the hands of the public authorities. The questions of London and the North-East Coast required special consideration, and the foregoing observations were not intended to apply to them.

The sum of £106 had been contributed towards the research on buried cables carried on by the Institution of Electrical Engineers.

The Council was strongly of opinion that the time had arrived when the Association should have branches in different localities throughout the kingdom for the more particular consideration of local questions. It was felt that there was great need for a combination of local authorities in different districts to deal with the many problems that would arise necessitating prompt action in connection with the future organisation of electricity supply. It had become imperative that in various localities arrangements should be made that would provide for meeting at more frequent intervals.

With regard to model general conditions of contract, the Council had adopted a recommendation made by the President and the Hon. Secretary as a result of a joint meeting between representatives of B.E.A.M.A., I.E.E., and I.M.E.A. Councils, that on future contracts the amount to be paid at the expiration of one month after the plant was taken over should be 15 per cent. instead of 10 per cent., and that the remaining 5 per cent. instead of 10 per cent. should be retained until the end of the period of maintenance. The B.E.A.M.A. had also raised the question of making payments on account prior to delivery, but as they formulated no proposals safeguarding the purchasers' interests the matter had not proceeded further.

At the annual conference of the National Association of Local Government Officers in May the important question of superannuation was reported upon. There was reason to look forward with confidence to this measure making favourable progress. The President of the Local Government Board had been approached, and Mr. Hayes Fisher decided to appoint a committee forthwith to inquire into and consider the whole question.

The Council was of the opinion that an increase or bonus should be granted to all salaried officials serving under local authorities on account of the decreasing purchasing power of money.

The Council called the attention of the Board of Trade to the financial burden imposed upon electricity supply authorities as a result of various statutory orders and restrictions, and subsequently the Board, in co-operation with the Ministry of Munitions, received a deputation of the I.M.E.A. As a result of the interview the Government Department concerned agreed that there should be an increase in the charges to controlled establishments, and that they would support undertakings in seeking a revision of the charges under all other long-term contracts.

As it was considered desirable to take united action on various matters relating to conditions of employment, remuneration of staff and employés, and emergency matters, the Council passed a resolution that a joint standing conference be constituted representative of the electricity supply industry generally. It was decided to communicate with the Incorporated Association of Electric Power Companies, the Provincial Electricity Supply Association of Great Britain, and the Conference of Staff Officials of Electric Supply Companies in London with a view to the formation of such a conference.

As a result a standing conference had been duly formed with Mr. C. P. Sparks as chairman and Mr. H. Faraday Proctor as hon. secretary, and several meetings had been held with beneficial results to the interests concerned.

It was further agreed that an executive committee of the Council should be appointed, with power to act in all emergency matters.

Information was received from the I.E.E. regarding the formation of a British Electrical Engineers' Association, to include chief engineers and assistants in electricity supply undertakings, and it was resolved: "That the Council approves the formation of the British Electrical Engineers' Association, and recommends the members of the I.M.E.A. to support it."

Owing to increased expenditure for printing and postage there was a deficit of £20 on the year's working.

Mr. J. E. Edgecombe had served the Association as hon. treasurer for 14 years, and the Council placed on record its appreciation of the services which he had rendered to the Association.

The question of training and employing disabled soldiers and sailors for sub-station attendants was discussed between representatives of the electricity supply industry and repre-

sentatives of the Electrical Trades Union. Agreement was arrived at as to the general basis of wages which should be paid and conditions under which employment of such men might be deemed to be acceptable to the employers and the Trade Unions.

There was throughout the year a fairly brisk demand for trained men; upon many occasions the demand exceeded the supply, and, generally speaking, satisfaction was expressed by the employers regarding the results obtained.

A Trade Advisory Committee (Disabled Soldiers and Sailors) Electricity (Power and Supply) had been formed, upon which the Association was represented by the President.

Electricity in Agriculture Committee.—The following were members of this Committee:—

Representing the Incorporated Municipal Electrical Association.—S. T. Allen, borough electrical engineer, Wolverhampton; F. Ayton, Ipswich Corporation Electric Supply and Tramways; S. E. Britton, city electrical engineer, Chester; J. Christie, engineer and manager, Brighton Corporation Electric Supply; W. T. Kerr, city electrical engineer, Hereford; F. M. Long, city electrical engineer, Norwich; H. Faraday Proctor, city electrical engineer, Bristol.

Representing the Incorporated Association of Electric Power Companies.—C. T. Allen.

Representing the National Farmers' Union.—E. W. Langford.

Representing other interests.—Lord Tollemache and F. R. S. Bircham.

The efforts of the Committee had not produced much practical result, and it was feared that little progress would be made until the emergencies of the war had been disposed of.

The Committee had attempted to make some progress with electroculture, and the use of electrical energy on farms, particularly with regard to electric ploughing and cheap methods of overhead transmission lines. Applications had been made to the Treasury for a grant from the Development Fund and the Ministry of Munitions for a permit for small quantities of materials. These applications were submitted to the Board of Agriculture, and, as the applications did not receive the support of the Board, were refused.

The thanks of the whole Association were specially due to Mr. H. Faraday Proctor, hon. secretary, for his valuable services. His duties and responsibilities during the past year had been exceptionally arduous.

The accounts showed an income of £563, and an expenditure of £583. The balance sheet showed a net surplus of assets over liabilities of £916.

CONSTANT-PRESSURE GENERATORS FOR WIRELESS TELEGRAPHY.*

By L. BOUTHILLON.

Numerous experimenters have used constant electromotive forces for charging the condensers used in wireless telegraphy. The author shows the reasons why, when faced with the task of developing a type of station for wireless telegraphy for the Postal and Telegraph Department of France, he has also chosen the system employing constant electromotive forces for charging the condensers and by selecting the best features of the system of Marconi and Blondel has formed a combination that is an advance on each of them. The paper is divided into four parts.

The first discusses the mode of operation of a charging circuit connected to a source of constant electromotive force and to a discharging circuit containing a gap. The second discusses the relative value of various types of generators and indicates the criteria for their suitability in wireless telegraphy. The third shows the particular characteristics of the system selected. The fourth consists of a comparison of the characteristics of this system with those of the usual alternating-current system.

The first part includes a mathematical examination of the theory of charging a condenser by a constant-pressure generator. It is shown that for the production of musical tones the successive condenser discharges must be regularly spaced at equal intervals, and that consequently successive charges must take place in the same constant time. Furthermore, the voltage across the condenser and the current flowing in it should be the same at the beginning of each charge. If the discharge is supposed to be complete at the time when the spark ceases and the voltage is zero across the condenser, then it follows that the current at the end of the discharge must be equal to the initial current if the current in the charging circuit remains constant during the entire discharge. The maximum efficiency is obtained at a spark frequency double that of the oscillations of the charge, *i.e.*, for one spark per half period. Curves are drawn showing the variations of potential across the condenser and of the efficiency as a function of the frequency of the musical tone for several values of the logarithmic decrement. It appears that the spark frequency may be multiplied by 3 in the case where $\delta = 0.4$ (a value rarely exceeded in practice) and by 7 in the case where $\delta = 0.1$ without diminishing the efficiency by more than 10 per cent. This is pointed out as an interesting characteristic of methods of charging condensers by sources of direct current. After a general consideration of the values of the initial current and of the potential difference at the terminals of the condenser, the inductance and the resistance during the charge, the energy expended in the charging circuit is calculated. The stability of the tone phenomena is considered. It is shown that if a rotary gap is employed, the tone phenomena are stable and occur automatically, regardless of the value of the current at the beginning of the first charge. In case a stationary gap is used, the spark always jumps when the potential difference reaches a certain definite value depending on the bridge distance. On this assumption the equations show that the musical phenomena are stable.

Part 2 contains a number of oscillograms showing repeated charging and discharging of the condenser. Regarding the best type of constant potential generator, it is pointed out that storage batteries have been found to be unsuitable owing to the trouble involved in their maintenance. The author has received tenders from several sources for the construction of direct-current machines for voltages of the order of 20,000 volts, and he is of opinion that no serious difficulty stands in the way of using such machines. The conditions that such machines should fulfil are set out in some detail. In discussing the relative advantages of stationary and rotary gaps it is concluded that it is more difficult to obtain a pure musical note with a constant pitch and intensity with a stationary gap than with a rotary gap. The second disadvantage of stationary gaps lies in the fact that variations in the sparking voltage prevent the attaining of tone phenomena with the maximum efficiency. In coming to this conclusion it is supposed that the spark frequency is not far from that corresponding to the maximum efficiency. If the spark frequency is much higher than this value, the contrary is true, and the stationary gap is preferable to the rotary gap.

In Part 3 the general characteristics of the system selected by the author are set out. The condensers are charged by direct-current high-voltage machines, with or without additional induction, and the discharge circuit includes a rotary gap.

Transmission cannot be accomplished by controlling the field circuit of the machine because of its large time constant. It is done by opening and closing the high-voltage current where it leaves the generator. Because of the high voltage, the switch or break is subdivided into several smaller portions, and the arc which tends to be formed is extinguished in the smaller stations by the air current from the rotary gap and in the larger stations by a seperate blower.

Experiments have been made with systems with powers reaching and exceeding 100 kw. and charging voltages between 10,000 and 110,000 volts. These tests have demonstrated that between these limits the use of the system presents no particular difficulty, and there is no reason why the same should not be the case for larger powers and still higher voltages.

Part 4, dealing with the comparison of the characteristics of direct-current and alternating-current systems, shows that the advantages of the direct-current system lie in the fact that the speed of rotation of the machines does not interfere with the regularity of the circuits, and the rigorous constancy of speed required with an alternator is not necessary, the efficiency obtainable is greater, the system is not so sensitive to changes in the speed of the rotary gap, the musical tone attained is purer, and lastly, the raising of the voltage by placing several generators in series is simple, and provides an easy means of regulating the available power, whereas in the case of alternators spark production in parallel is quite a delicate task.

* *Proceedings* of the Institute of Radio Engineers. Abstract.

ELECTRICITY SUPPLY IN SHANGHAI.

We have received from Mr. A. H. Blagden, A.M.I.E.E., acting engineer-in-chief and manager of the electricity department of the Shanghai Municipal Council, a copy of his report for 1917, which states that the year under review was the most difficult one with which the department ever had to deal. Owing to the serious breakdowns in November it was necessary to restrict the supply of power between 4 and 10 p.m., and all sign and outside lighting was cut off, giving preference to house lighting, until sufficient plant should be installed capable of meeting all demands. All reasonable precautions were taken to obtain the necessary additional plant required, and it was only owing to war conditions that the new plant had not been delivered and put into commission. The department was suffering from the cumulative effects of serious plant shortage for several years. It was, however, gratifying to record the fact that, due to alterations to the boilers at Riverside, it had been possible with the same boilers to meet an increased load of 2,500 kw.

In October the new 10,000-kw. G.E.C. set was put into commission, and had been on continuous load since that time; from October 4th to December 31st it generated 68 per cent. of the total units, which were 24,615,680. An increase in the works costs was shown, due entirely to the higher price paid for coal, the cost per unit sold being 0.636d.

The plant capacity was 29,600 KW.; the maximum load 20,927 KW., which would have reached over 22,000 KW. had it not been necessary to make certain restrictions to the supply. The load factor of 44.38 was the highest ever recorded, and it will be noticed that it is higher than in any of the five largest municipal undertakings in Great Britain. The total units generated amounted to 96,921,287, and the units sold were distributed as follows:—Private lighting, 15,206,019, an increase of 6.44 per cent.; public lighting, 1,128,896, an increase of 6.62 per cent.; heating and cooking, 1,129,754, an increase of 25.58 per cent.; power, 57,182,340, an increase of 36.01 per cent.; traction, 3,843,433, a decrease of 0.78 per cent. The all-round increase of 26.27 per cent. would seem very satisfactory under the restricted supply conditions, and as soon as conditions again become normal increases on a much larger scale are expected.

During the year 104.57 miles of cable were erected for extending the overhead mains, and 7.44 miles of E.H.T., 1.08 miles of L.T., and 0.12 mile of pilot cable were laid. The changing over of the single-phase districts to three-phase is being carried out as opportunity serves; at the present time it is impossible to obtain some of the switchgear required for the purpose. The sub-stations number 62, with a transformer capacity of 30,767.5 KW., an increase of 10,574.5 KW., while three new sub-stations are in course of construction. Alterations have been carried out to the lighting mains, and additional sectionalising plugs inserted, enabling tests and repairs to be more quickly carried out. The total number of metal-filament street lamps connected at the end of the year was 1,718. The net increase in house service connections was 1,594, or a total of 23,453 at the end of the year. In spite of the restrictions placed on the additional connections of radiators, the units sold for heating and cooking purposes increased by 25.58 per cent. The effects of the war upon working results of the power department were less than anticipated. The total number of motors connected was 1,527, with a total horse-power of 23,535, being increases of 18 per cent. and 16 per cent. respectively on the previous year.

The year's business resulted in a net profit of £58,739 after meeting all capital charges and writing off £48,470 for depreciation. The estimated profit was £38,725, the increase being accounted for by interest charges of £11,197 less than allowed for, and by the additional sale of 7,000,000 units.

The four new trunk mains between Riverside and Fearon Road were completed, and are in use at 6,600 volts. They cannot be used at their designed pressure of 22,000 volts until re-arrangement of plant has been made.

The new switch and transformer house has been completed and most of the switchgear delivered. Two of the new boilers have been erected and are complete; four more boilers can be erected and finished during the year. The new buildings are nearly completed; the overhead coal bunkers in the boiler-house have been erected. The plant most urgently required is the 5,000-KW. Fraser & Chalmers set, and the circulating pumps for condensing purposes, which are being made by Mather & Platt. The turbine set has been finished for several months, but the necessary tests have been delayed at the manufacturers' works owing to the pressure of Government work.

Mr. Aldridge in July reported on certain extensions which were considered very urgent; in view of the present uncertain conditions as to the delivery of materials, he was authorised to proceed to America, and call for tenders for the plant required. Orders have been placed with the General Electric Co. for one 20,000-KW. turbo-generator set, one synchronous condenser, and one 600-KW. motor generator with the Westinghouse Co. As previously reported, very serious defects had developed in the two 5,000-KW. turbo-generators at Riverside, and it is now considered necessary that an additional 5,000-KW. machine should be ordered at once.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,374. "Incandescent electric lampholders and switches therefor." J. G. BARBER AND DRAKE & GORHAM. June 24th.

10,380. "Electric time-limit device." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) June 24th.

10,382. "High-frequency signalling." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) June 24th.

10,388. "Accumulator-container and material therefor." M. GREENHILL. June 24th.

10,408. "Sparking plug electrodes." E. P. FOREMAN. June 24th.

10,412. "Electromagnetic wave transmission." B. BINYON. June 24th.

10,417. "Electric heating and cooking apparatus." G. W. L. PATTERSON. June 25th.

10,418. "Electric cigar, cigarette, and pipe-lighter." G. W. L. PATTERSON. June 25th.

10,448. "Magneto motor." D. SUCHOSTAWER. June 25th.

10,453. "Charging material to electro-osmotic apparatus for removing liquids from substances." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,454. "Electrodes for electro-osmotic processes." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,455. "Electro-osmotic process for removing water from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,456/9. "Apparatus for electro-osmotically removing water." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,457. "Apparatus for electro-osmotically removing liquids from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,458. "Apparatus for electro-osmotically removing water from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,460. "Electro-osmotically removing water from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, December 12th, 1917.)

10,462. "System of electrically indicating on board ship the depth of sea-water." Y. KAWAKITA. June 25th.

10,466. "Electric contact-breakers or interruptors." G. F. COOKE. June 25th.

10,467. "Electric ignition devices." F. L. HOLLISTER. June 25th.

10,477. WIRELESS TELEGRAPHY AND TELEPHONY. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. June 25th. (Germany, July 12th, 1917.)

10,480. "Sparking plugs for internal-combustion engines." G. H. AVELINE AND F. SOUAILLE. June 25th.

10,488. "Electrical resistances." QUEAD, LTD., & J. C. C. MACDONOGH. June 25th.

10,491. "Electro-deposition of zinc and nickel." H. LOWENTHAL. June 26th.

10,500. "Devices for locking incandescent electric lamps in their holders." G. F. COLSON. June 26th.

10,526. "Telephonically transmitting speech." P. L. JENSEN & E. S. PRIDHAM. June 26th.

10,535. "Ignition plugs." W. F. M. EDWARDS. June 26th.

10,548. "Electric generator for motor vehicles." J. GAMBS. June 26th. (France, July 2nd, 1917.)

10,550. "Device for ensuring liquid-tight passage for connections of accumulators with containers made of celluloid." A. DININ. June 26th. (France, July 25th, 1917.)

10,577. "Single-phase commutator-type electric motors." S. H. FIELDEN AND RHODES MOTORS, LTD. June 27th.

10,601. "Appliance for removing, replacing, or cleaning electric, &c., lamp globes, &c." R. TAYLOR. June 27th.

10,626. "Dynamo-electric machines." VICKERS, LTD., & S. F. BARCLAY. June 27th.

10,630. "Means for production of high-tension electrical discharges." R. E. H. CARPENTER AND CREED & CO. June 27th.

10,640. "Electric pencils for retouching photograph negatives." W. H. FRANKLIN. June 28th.

10,644. "Three-phase action for centrifugal flour-dressers, centrifugal scalpers, &c." E. L. COX & M. RANKIN. June 28th.

10,654. "Electromagnets." M. H. GOLDSTONE. June 28th.

10,658. "Electrolytic cells." C. I. SYNDICATE & H. C. JENKINS. June 28th.

10,665. "Devices for suspending electric lamps, &c." J. W. LANCASTER. June 28th.

10,671. "Improvements in telephones, also applicable to wireless receivers and transmitters." G. M. MASTERS. June 28th.

10,673/4. "Sparking plugs for internal-combustion engines." A. M. LODGE, AND LODGE SPARKING CO. & B. HOPPS. June 28th.

10,676. "Electrical apparatus for indicating and repeating movements at a distance." SCHNEIDERET CIE. June 28th. (France, February 13th.)

10,687. "Electric railway systems." E. J. PATELSKI. June 28th.

10,702. "Modulating means for high-frequency oscillations." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) June 28th.

10,714. "Direction-finders, &c., for wireless signalling." R. E. VAUGHAN. June 28th.

10,717. "Receivers for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO. & C. S. FRANKLIN. June 28th.

10,728. "Sparking plug for internal-combustion engines." J. H. FENWICK AND F. GOODSON. June 29th.

10,747. "Dynamo-electric machines." A. G. A. KAULBACK. June 29th.

10,760. "Electric ovens, &c." C. R. BELLING. June 29th.

10,763. "Electromagnetic relay for railway signalling, &c." F. W. LEAKE AND TYER & CO. June 29th.

10,771. "Apparatus for obtaining high-tension one-direction currents from three-phase currents." G. C. TRAVACCHI & O. M. CORBINO. June 29th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

5,177. ELECTRICALLY FUSING AND DEPOSITING METAL. E. H. Jones. April 12th, 1917. (116,308.)

8,826. PORTABLE ELECTRICAL DRYER FOR LOCAL DRYING OF DRAWINGS AND THE LIKE. T. Lavender & J. R. Pannell. June 20th, 1917. (116,373.)

9,206. IGNITION PLUGS FOR INTERNAL-COMBUSTION ENGINES. H. G. Longford, W. W. Longford & W. A. Clark. June 27th, 1917. (116,379.)

10,182. BLOW-OUT SPARK DISCHARGERS FOR IMPULSE EXCITATION AND FOR A HIGH-SPARK FREQUENCY. June 2nd, 1917. (116,301.) (Addition to 108,300.)

10,363. IGNITION PLUGS AND THE MANUFACTURE OF THE SAME. H. G. Longford, W. W. Longford & W. A. Clark. July 8th, 1917. (116,392.)

10,615. MAGNETO-ELECTRIC MACHINES FOR IGNITION IN INTERNAL-COMBUSTION ENGINES. M. S. Conner & C. C. Puckette. July 24th, 1917. (115,399.)

10,766. PRISMATIC GLASSWARE FOR ILLUMINATING PURPOSES. Holophane, Ltd. (Holophane Glass Co., U.S.A.) July 26th, 1917. (116,309.)

12,727. ELECTRO-PNEUMATIC BRAKING SYSTEMS. W. V. Turner. April 17th, 1917. (115,016.)

13,208. ELECTRIC SIGNALLING SYSTEMS, MORE PARTICULARLY FOR USE IN MINES. Automatic Telephone Manufacturing Co. & C. Remington. September 15th, 1917. (116,426.)

16,264. RAILWAY SIGNALLING SYSTEMS AND RELAYS ADAPTED FOR USE THEREIN. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch and Signal Co., U.S.A.) November 7th, 1917. (116,454.)

16,268. OVENS OR FURNACES FOR USE IN BAKING CARBON ELECTRODES AND FOR OTHER PURPOSES. R. K. Wehner. November 7th, 1917. (116,455.)

16,726. PORTABLE ELECTRIC LAMPS. F. Westwood. November 14th, 1917. (116,457.)

17,801. JOINTS FOR ELECTRIC WELDING OF THIN MATERIAL. F. Blomley. December 1st, 1917. (116,461.)

1918.

3,167. ROTARY ELECTRIC SWITCHES. T. Ammann. February 21st, 1917. (113,621.)

3,575. DYNAMO-ELECTRIC MACHINES. J. W. Burleigh. June 29th, 1917. (Divided application on 9,350/17.) (116,481.)

3,768. CONSTRUCTION OF DIAPHRAGM FOR USE IN SOUND-RECORDING AND SOUND-REPRODUCING MACHINES, TELEPHONES, AND OTHER INSTRUMENTS IN WHICH VIBRATING DIAPHRAGMS ARE EMPLOYED. H. A. McInnes. March 4th, 1918. (116,482.)